

**APPENDIX J. MODELING OF SUSPENDED SEDIMENT RESULTING FROM
DREDGING OPERATIONS AT THE PROPOSED MASONVILLE SITE**

1. Introduction

An Environmental Impact Statement is being conducted to examine the potential of Masonville to be used as a confined containment site for dredged material from Harbor channels and anchorages of the Port of Baltimore. Masonville is located in the Fairfield area of south Baltimore City. The Masonville site is bordered by the Patapsco River and Ferry Bar Channel to the north, industrial sites to the south, and approximately 55 acres of habitat protection area to the west.

The Masonville implementation plan includes constructing the impoundment dike from on-site materials. The silty overburden is to be removed, and the dike constructed from the underlying sands. The object of this report is to examine sediment plumes generated from the associated dredging operations. This includes (1) removal of the silty overburden with a clamshell dredge, (2) mining sand from the borrow with a cutterhead dredge, and (3) dredged material placement during dike construction. These objectives will be met by modeling the sediment plumes with the USACE-WES DREDGE model. DREDGE was developed to assist users in making a priori assessments of environmental impacts from proposed dredging operations (D.F. Hayes 2000). DREDGE estimates the mass rate at which bottom sediments become suspended into the water column as the result of hydraulic and mechanical dredging operations. The model also includes analytical transport modules to predict the fate of the resuspended sediments in the near and far field. These modules allow the presentation of the spatial distribution of TSS and constituent concentrations in the water column.

Maryland Water Quality Regulations

The Maryland water quality regulations address both the size and turbidity limits for a chronic mixing zone.

- For conventional pollutants, the allowed mixing zone in Maryland estuarine waters is defined as 10-percent of the cross-sectional area of the receiving water body (focusing on the mean water level and average tidal velocity).
- Turbidity limits in the surface water resulting from any discharge may not exceed 150 NTUs at any time, or 50 NTUs as a monthly average.

The DREDGE model simulates the suspended sediment plume as concentrations of total suspended solids (TSS). In order to relate these model results to Maryland's water quality standards for turbidity, a relationship between these two parameters must be established. Several data sources for this relationship in waters associated with Baltimore Harbor are available. Figure 1-1 displays turbidity and TSS data collected at Hart Miller Island (HMI) spillways. The HMI dredged material containment site contains sediment dredged from Baltimore Harbor. Figure 1-1 indicates that a 50 NTU turbidity is equivalent to approximately 80-mg/L TSS; and a 150 NTU turbidity value is equivalent to approximately 200-mg/L TSS. A second source of sediment data is the monitoring program for dredge operations during the construction of the I-

95 Fort McHenry tunnel. This database contained data for both the dredging operations and the discharge from the containment site (EA 1984). The I-95 monitoring data are displayed in Figure 1-2. A regression analysis of this data related a 150 NTU turbidity to a 240-mg/L TSS. This 150 NTU/240-mg/L TSS data point is also displayed with the HMI spillway data in Figure 1-1.

For purposes of interpreting the TSS results in the following report, therefore, compliance with a 50 NTU standard will be compared to a 50-80-mg/L TSS range, and compliance with 150 NTU will be compared to a 150-240-mg/L TSS range.

The Middle Branch at the Masonville site has a cross-sectional area of approximately 6,819 m² at mean tide level. Ten percent of the cross-sectional area is therefore 681.9 m². Sediment plume cross-sectional areas will be calculated from model results and compared to this value.

2. Clamshell Dredging of the Overburden

2.1 Physical Site Characteristics

Particle size information for the overburden was available at five stations associated with the Masonville site (Table 2-1). The data at the five stations were averaged to form a composite sample for use in the model. The overburden material is generally described as a dark gray organic silt with a trace of sand. The composite characteristics are 0.4-percent gravel, 12.3-percent sand, 56.3-percent silt, and 31.0-percent clay (Table 2-1). The median (50-percentile) particle diameter is 12.4 um. The specific gravity of this material is 2.55 gm/cm³ based on three samples at similar locations (EA November 2004, Table II-3).

The maximum ebb and flood current velocities at the Masonville site where the dredging will take place are 10 cm/sec with a predominant direction east to west (personal communication, Peter Kotulak, Moffat & Nichol). Velocities associated with other tidal conditions were also determined. A 6-cm/sec velocity was used to represent an average tidal condition and a 2-cm/sec velocity was used to represent a near slack water condition.

Water depths in the vicinity of the proposed containment area and extending out to the edge of Ferry Bar Channel are typically 10-13 feet deep (MLW). An 11.8-ft (3.6 m) depth was used in the model for the dredging of the overburden.

2.2 Previous Application of the DREDGE Model in Baltimore Harbor

The U.S.ACE DREDGE model was applied to monitoring data collected in the Baltimore Harbor adjacent to the Seagirt Marine Terminal during March 2003 (EA 2003). During this earlier study, U.S.ACE-WES conducted detailed TSS plume mapping surveys downstream from the dredge point while dredging operations were taking place. EA applied the DREDGE model to the site and used the U.S.ACE-WES TSS plume mapping data for model calibration. The dredged material from the 2003 Baltimore Harbor study was similar to the Masonville site (9.6-percent sand, 55.9-percent silt, and 34.6-percent clay). An average dispersion coefficient of 4 m²/sec was selected as part of the calibration process for use during both flood and ebb tides.

The size of the sediment source term resulting from the dredging operation was also a model calibration parameter. The model used the option where the sediment source term is defined as a loss rate from the clamshell dredge. Based on calibrating the model to the observed TSS plume, a 1.5-percent loss rate from a 20-yd³ dredge was determined.

The 4-m²/sec dispersion coefficient, and 1.5-percent loss rate determined during model calibration for a similar dredging operation, were applied at the Masonville site. Dispersion coefficients are dependent on the current velocity. For the 2 cm/sec near slack water condition, a lower dispersion coefficient of 2 cm/sec was used.

2.3 Modeling TSS for the Removable of Overburden

The DREDGE model was applied to the Masonville site to predict the suspended TSS plume resulting from the clamshell dredging of the overburden materials. The DREDGE model assumes that the sediment source for a clamshell dredge is distributed vertically through the water column. The predicted TSS values in the model output are also vertically averaged water column values. The basic parameters required by the model are summarized below.

Volume clamshell bucket	15.3 m ³ (20 yd ³)
Cycle time	60 sec
Dispersion Coefficient	4 m ² /sec
Water depth	3.6 m
Fraction of material < 74 um	87.3 percent
Median particle diameter < 74 um	9.2 um

The above clamshell dredging parameters and the 1.5-percent loss rate results in a 2.23-kg/sec sediment source term to the water column. The DREDGE model assumes that sand drops from the water column in the near field and that only the fines (< 74 um) remain to be transported by the model. The 9.2 um particle diameter used in the model was the median of that portion of the particle distribution less than 74 um. The DREDGE model option that calculates a settling velocity based on Stokes equation for a spherical particle was used.

Several DREDGE model sensitivity runs were made to demonstrate that particles larger than 74 um rapidly settle out in the near field. The model was executed for particle diameters of 50 um, 74 um, and 100 um with the following results.

TSS Concentration (mg/L) at Downstream Distance

Diameter (um)	20 m	40 m	60 m	80 m	100 m
50	46.9	37.8	24.0	16.3	11.4
74	6.6	2.3	0.7	0.2	0.07
100	0.11	0.0	0.0	0.0	0.0

A 74 um diameter particle is the boundary between a fine sand and silt. Fine sand particle diameters range from 74 um to 425 um. These model results demonstrate that 100 um fine sand particles are almost entirely removed from the water column within a 20-m downstream distance.

Results of model runs performed for 10-cm/sec, 6-cm/sec, and 2-cm/sec tidal velocities are provided in Attachment Tables A-1 to A-3. These tables display vertically averaged TSS concentrations at 100-m intervals for a 1,000-m downstream distance and at 50-m lateral intervals for 500-m on either side of the plume centerline. Centerline TSS concentrations are presented in Figure 2-1 for the three modeled tidal velocities. Figure 2-1 indicates that centerline TSS concentrations increase with decreasing tidal velocity. The 6-cm/sec TSS concentrations are slightly higher than the 10-cm/sec values. At the 2-cm/sec near slack water velocity, near-field TSS concentrations increase as a result of both reduced tidal flow for dilution and the decreased dispersion coefficient. The DREDGE model simulates the suspended sediment plume as a steady state distribution. At a 2-cm/sec velocity, the travel time to the 300-m downstream transect is 4.2 hours. This time exceeds the duration of the near slack water period associated with a 2-cm/sec velocity. Thus, model predictions beyond a 300-m downstream distance are not representative of actual occurrences. In addition, at a 2-cm/sec tidal velocity, the lateral extent of the predicted plume may exceed the buildup that actually occurs during a near slack water period.

Maryland regulations for conventional pollutants allow a chronic mixing zone equal to 10-percent of the cross-sectional area of the receiving water. Water quality standards for turbidity contain 150 NTU maximum and 50 NTU monthly average values. As discussed in Section 1, compliance with a 50 NTU turbidity standard has a potential range of 50-70 mg/L TSS, and compliance with a 150 NTU turbidity standard has a potential range of 150-240-mg/L TSS. The cross-sectional areas associated with 20-m to 100-m downstream transects for each of the three clamshell scenarios are provided in Table 2-2. The Maryland water quality standards for chronic criteria refer to evaluations based upon *average* tidal conditions. Cross-sectional areas for the 6-cm/sec average tidal condition are summarized below.

Cross-Sectional Area (%) for TSS Concentration

Downstream Distance (m)	Monthly Average Criterion		Maximum Criterion	
	50 mg/L	70 mg/L	150 mg/L	240 mg/L
20	5.2	1.7	0.0	0.0
60	0.0	0.0	0.0	0.0

These data indicate compliance with Maryland regulations during the overburden removal phase of the project.

3. Cutterhead Dredging of Sand from the Borrow

After removal of the overburden, the underlying sand will be dredged for construction of the containment dikes. This operation results in two suspended sediment plumes; one at the point of dredging, and the second at the placement location along the dike. The sediment plume resulting from the dredging operation is discussed in this section and the plume from material placement will be discussed in Section 4.

3.1 Cutterhead Dredge and Sediment Characteristics

The rate of sediment resuspension into the water column is proportional to the sediment removal rate by the cutterhead dredge. Cutterhead dimensions, and proposed dredging rates used in the assessment are provided below (GBA, personal communication).

Cutterhead:

Length	2.1 m (7 ft)
Diameter	1.5-2.4 m (5-8 ft)

Dredging rate

Sand	2,400 yd ³ /hr (0.510 m ³ /sec)
Hard Clay	920 yd ³ /hr (0.195 m ³ /sec)

Thickness of cut:

Sand	1.5 m (5 ft)
Clay	0.9 m (3 ft)

Swing velocity:

Sand	0.170 m/sec (33.4 fpm)
Clay	0.098 m/sec (19.3 fpm)

Cutter (RPM)

10-20

Flow rate

Sand	2.36 cms (83.3 cfs)
Clay	2.70 cms (95.4 cfs)

Sediment characteristics based on borings collected below the overburden are summarized in Table 3-1. The table contains particle distribution data for eight samples from 5 stations (2 depths at 3 of the stations) with depths ranging from 8-13 ft to 26-33 ft. The eight locations had sand ranging from 33 to 74 percent of the sample and averaged 52.1 percent. The average gravel content was 18.6 percent. The eight locations were averaged into a composite sample for use in the model and these results are also provided in Table 3-1. The composite particle distribution will be referred to as sand.

The composite particle distribution represents expected conditions during the majority of the dredging operation. The mass rate of fines released to the water column is dependent on the proportion of fines in the sediment. A worst-case scenario was constructed based on the sediment sample with the highest clay content. The core sample beneath the overburden with the highest clay content (and correspondingly decreased sand) was at Location 05A for the 25-27.5 ft depth interval. Particle characteristics for this sediment sample are provided in Table 3-1. This sample contained 38.0-percent clay, 25.5-percent silt, and only 18.7-percent sand. This distribution is referred to as soft clay. Because of the layering of the sediment, a 5-ft thick cut by the cutterhead may not be entirely contained within a soft clay layer. A third particle distribution was therefore defined as the average of the composite and the soft clay distributions. This distribution is referred to as sand/clay. The hard red Arundel clay layer is present below the borrow. This hard clay was assumed to be 5-percent sand, 10-percent silt, and 85-percent clay. The four particle distributions associated with the borrow are summarized in the following table.

Material	Sand	Sand/Clay	Soft Clay	Hard Clay
Sand & Gravel (%)	70.7	53.6	36.5	5
Silt (%)	17.4	21.5	25.5	10
Clay (%)	11.9	24.9	38.0	85
Fines <74 um (%)	29.3	46.4	63.5	95
Diameter <74 um	9.3	4.9	3.6	2.9

The above table also contains the median particle diameter for the fines portion of the material. The model calculates a settling velocity corresponding to the Stoke's velocity for a spherical particle.

3.2 Estimation of Resuspended Sediment Source Rate

For a cutterhead, the DREDGE model uses a turbidity generation unit (TGU) method for determining the source strength. A dredge removal rate is calculated from the width, depth, and lateral velocity (swing velocity) of the cutterhead. A TGU is then applied that relates the rate of resuspended sediment to the total volume of dredged material. The DREDGE model assumes that only fine sediments (< 74 um) remain suspended and are transported beyond the near field. TGU values increase with an increasing fraction of fines in the sediment. TGU values are provided in the DREDGE user manual as a function of both the type of dredge and the sediment characteristics (D.F. Hayes 2000). TGU values for a cutterhead dredge are presented in Figure 3-1 as a function of the fraction of material less than 74 um. A power law relationship was fitted to the data and included in Figure 3-1. For the 29.3 percent fine sediment fraction associated with the composite sample, the TGU from the regression is approximately 3.5 kg/m^3 . As a conservative estimate, a TGU of 5 kg/m^3 was used in the model. TGU values for the other sediment distributions were selected using values conservatively above the regression line shown in Figure 3-1. The selected TGU values and the resulting sediment mass release rates to the water column are summarized in the following table.

Parameter	Sand	Sand/Clay	Soft Clay	Hard Clay
Dredge Rate (m^3/sec)	0.510	0.510	0.510	0.195
TGU (kg/m^3)	5	8	12	20
Release Rate (kg/sec)	2.55	4.08	6.12	3.91

3.3 DREDGE Model Results for Cutterhead

For a cutterhead, the DREDGE model predicts TSS concentrations as a function of distance above the bottom. The model was executed for water column heights of 0.5-m, 1-m, 2-m, and 3-m. The near bottom concentrations are insensitive to the assumed water column depth. A 5.6-m (18.4-ft) water column was used in the model to represent an approximate site depth after removal of the overburden.

The DREDGE model was executed for each of the four particle distributions (sand, sand/clay, soft clay, hard clay) at three tidal velocities (10 cm/sec, 6 cm/sec, 2 cm/sec). The model-predicted TSS concentrations are provided in Attachment A:

- Tables A-4 to A-6 Sand for 3 tidal velocities
- Tables A-7 to A-9 Sand/clay for 3 tidal velocities
- Tables A-10 to A-12 Soft clay for 3 tidal velocities
- Tables A-13 to A-15 Hard clay for 3 tidal velocities

Each table provides centerline TSS concentrations at 0.5-m to 3.0-m heights above the bottom at distance of up to 1,000-m downstream. The tables also contain cross sections at 20-m, 100-m, 200-m, and 400-m downstream distances for a 500-m lateral width from the plume centerline. At a 2-cm/sec velocity, the travel time to the 300-m downstream transect is 4.2 hours. This time exceeds the duration of the near slack water period associated with a 2-cm/sec velocity. Thus, model predictions beyond a 300-m downstream distance are not representative of actual occurrences. In addition, at a 2-cm/sec tidal velocity, the lateral extent of the predicted plume may exceed the buildup that actually occurs during a near slack water period.

The highest TSS concentrations are located near the bottom. Centerline TSS concentrations at 0.5-m (near bottom) and 2-m heights above bottom are summarized in Table 3-2. Near field TSS concentrations increase as the tidal velocities decrease from 10 cm/sec to 2 cm/sec. For the 10 cm/sec and 6 cm/sec tidal velocities, all near bottom (0.5 m) TSS concentrations are less than 75 mg/L at a 100-m distance and below 38 mg/L at a 200-m distance. For a 10-cm/sec velocity and a 100-m downstream distance, TSS concentrations at a 2-m from the bottom height are typically one-half of the near bottom concentrations.

Maryland regulations for conventional pollutants allow a chronic mixing zone equal to 10-percent of the cross-sectional area of the receiving water. As discussed in Section 1, compliance with a 50 NTU monthly average turbidity has a potential conversion range of 50-70-mg/L TSS, and compliance with a 150 NTU maximum turbidity has a potential conversion range of 150-240-mg/L TSS. The cross-sectional area associated with 20-m to 200-m downstream transects for each of the 12 particle distribution and tidal velocity scenarios are summarized in Table 3-3. The largest cross-sections were for soft clay, which had 63.5 percent fines. At a 20-m downstream transect, the cross-section for soft-clay increased from 2.6-percent at 10-cm/sec, to 9.7-percent at 2-cm/sec. At a 200-m downstream transect, there was a zero cross-sectional area for all scenarios except for soft-clay at a 2-cm/sec tidal velocity.

TSS contours in the cross-section of Middle Branch are illustrated in Figure 3-2 for sand/clay (46.4 % fines) at a 2-cm/sec velocity. The high fines content and low tidal velocity provides a short duration worst-case condition. Figure 3-2 illustrates that a significant portion of the cutterhead sediment plume is contained within the borrow and below the natural bottom contour of Middle Branch. A plane view of near bottom (0.5 m) TSS contours for soft clay (63.5 % fines) and the 6-cm/sec tidal average condition are presented in Figure 3-3. Figure 3-3 indicates that the 50-mg/L TSS contours extends approximately 166-m downstream and has a 120-m width from the plume centerline.

Compliance with water quality standards on a monthly bases is determined by averaging over both tidal conditions and possible particle distributions. The Maryland water quality standards for chronic criteria refer to average tidal conditions. The average tidal condition is represented by the 6-cm/sec tidal velocity scenario. Material types in the borrow below the overburden were summarized based on data provided by GBA. At a 50-ft depth (MLLW) the composition of the borrow material is described as follows:

Borrow Material	Volume (%)	Assignment
Upper Sand & Gravel	55.1	Sand
Silts & Soft Clay	8.8	Sand/Clay
Borrow Clay	6.3	Soft Clay
Lower Sand & Gravel	19.1	Sand
Red Clay	10.7	Hard Clay

The above table also indicates the assignment of the four material types used for the modeling to the borrow material. The upper and lower sand & gravel were combined for a 74.2-percent sand fraction. The cross-sectional area results for the four modeled particle distributions were combined into a weighted averaged by using the volume fractions in the above table. This was performed for the tidal average 6-cm/sec velocity condition. The resulting averaged cross-sectional areas associated with cutterhead dredging from the borrow are provided below.

Cross-Sectional Area (%) for TSS Concentration

Downstream Distance (m)	Monthly Average		Maximum	
	50 mg/L	70 mg/L	150 mg/L	240 mg/L
20	2.54	1.76	0.26	0.0
100	0.24	0.04	0.0	0.0
200	0.0	0.0	0.0	0.0

Based on the above TSS results for a 50-240-mg/L range of TSS concentrations, cutterhead dredging in the borrow is expected to be in compliance with the 50 NTU monthly average, and 150 NTU maximum water quality standards.

4. Placement of Dredged Material During Dike Construction

4.1 Model Characteristics

The dredged material resulting from the cutterhead operation in the borrow will be transported to the dike construction site through a 32-inch diameter pipe. At the construction site, the dredged material is discharged into the water column. The placement of the dredged material was modeled for the same three tidal velocities and four particle distributions as modeled for the cutterhead operation in the borrow. Models to simulate the placement of dredged material were reviewed including CDFATE and DCORMIX. For a pipe release, the CDFATE model uses DCORMIX. Trial runs with DCORMIX contained unrealistic results associated with transitions between near field and far field modules. Following this review, it was decided to use the DREDGE model for material placement, with an additional provision to determine the fraction of fines remaining in the water column after the initial release. Following the discharge of dredged material to the water column, a fraction of the fines are entrained and removed from the water column during the first several minutes as the larger sand particles settle to the bottom. This initial release was modeled with the USACE WES STFATE model. This approach was suggested by Dr. Donald Hayes, a co-author of the DREDGE model (Donald Hayes, University of Utah, personal communication). The STFATE model simulates the short-term fate of discharged dredged material including clumps, sand, silt and clay and their interactions.

The mass discharge rate and particle distribution for each of the 12 placement scenarios was modeled with STFATE. The discharge was placed at a mid-water column depth. The silt and clay fractions remaining after 10-minutes were used as a mass loading to the DREDGE model. The fines fraction remaining after 10-minutes and related sediment loading parameters are summarized in Table 4-1. The fraction of fines remaining in the water column was 12-13-percent for the sand particle distribution. The remaining fines fraction decreased slightly to 9.3-9.5-percent for the soft clay distribution. As the total fraction of fines increased, the higher concentration of fines resulted in increased entrainment and a lower percentage of fines remaining in the water column.

Table 4-1 provides the dredging rate and the fraction of fines for each of the 12 placement scenarios. Multiplying the total dredging rate by the fraction of fines (< 74 um) yields the mass rate of fines available to the water column. Multiplying the available fines by the percentage of fines remaining from the STFATE model yields the mass source rate of fines to the water column. This mass rate of fines to the water column is the sediment source rate input to the DREDGE model. The sediment source rate increased from 24.9-26.3 kg/sec for sand, to 39.5-40.2 kg/sec for soft clay.

Studies have indicated that during cutterhead dredging of hard clay and subsequent transport through a pipeline, 80-90 percent of the dredged material remains as clay balls. These clay balls (clumps) rapidly settle in the near field, removing a significant fraction of the fines. For the Masonville site, it was conservatively assumed that 70-percent of the hard clay material settles as clumps. Due to the decreased concentrations of the remaining fines, the percentage of fines remaining in the water column after 10 minutes (STFATE) increased to 21.0-23.4 percent. The resulting mass rate of fines to the water column was 17.3-19.2 kg/sec.

4.2 Model Results for Placement During Dike Construction

The material placement during dike construction was modeled with DREDGE in a mode that predicts TSS concentrations as a function of distance above the bottom. The model was executed for water column heights of 1-m, 2-m, 3-m, and 4-m from the bottom. The 4-m (13-ft) water column depth used in the model is representative of mean water depths along the northern dike.

The DREDGE model was executed for each of the four particle distributions (sand, sand/clay, soft clay, hard clay) at three tidal velocities (10 cm/sec, 6 cm/sec, and 2 cm/sec). The model predicted TSS concentrations are provided in Attachment A:

- Tables A-16 to A-18 Sand for 3 tidal velocities
- Tables A-19 to A-21 Sand/clay for 3 tidal velocities
- Tables A-22 to A-24 Soft clay for 3 tidal velocities
- Tables A-25 to A-27 Hard clay for 3 tidal velocities

Each table provides centerline TSS concentrations at 1-m to 4-m heights above the bottom at distance of up to 1,000-m downstream. The tables also contain cross sections at 100-m, 200-m, and 400-m downstream distances for a 500-m lateral width from the plume centerline. The DREDGE model simulates the suspended sediment plume as a steady state distribution. At a 2-cm/sec velocity, the travel time to the 300-m downstream transect is 4.2 hours. This time exceeds the near slack water period associated with a 2-cm/sec velocity. Thus, model predictions beyond a 300-m downstream distance are not representative of actual occurrences. In addition, at a 2-cm/sec tidal velocity, the lateral extent of the predicted plume may exceed the buildup that actually occurs during a near slack water period.

The highest TSS concentrations are located near bottom. Centerline TSS concentrations at 1-m and 3-m heights above bottom are summarized in Table 4-2. For 10-cm/sec and 6-cm/sec tidal velocities at a 1-m near bottom depth, centerline TSS concentrations were less than 240 mg/L by a 200-m downstream distance. For the same velocity conditions, TSS concentrations were below 150 mg/L by a 100-m downstream distance.

Maryland regulations for conventional pollutants allow a chronic mixing zone equal to 10-percent of the cross-sectional area of the receiving water. As discussed in Section 1, compliance with a 50 NTU monthly average limit has a potential range of 50-70-mg/L TSS and compliance with a 150 NTU maximum limit has a potential range of 150-240-mg/L TSS. The cross-sectional area associated with 100-m to 400-m downstream transects for each of the 12 particle distribution and tidal velocity scenarios are summarized in Table 4-3. At a 100-m downstream transect, the cross-section area for a 10-cm/sec velocity and a 70-mg/L TSS concentration increased from 8.6-percent for sand to 11.5 percent for soft clay.

TSS contours in the Middle Branch cross-section are provided in Figure 4-1 for sand (29.3 % fines) at the 6-cm/sec tidal average velocity. In Figure 4-1, the cross-sectional areas corresponding to the contours are 17.3-percent for the 50-mg/L TSS contour, 6.5-percent for

150-mg/L contour, and 1.8-percent for the 240-mg/L contour (Table 4-3). Plane view near bottom (1-m) TSS contours of sand (29.3 % fines) at the 6-cm/sec tidal average velocity are provided in Figure 4-2. The 50-mg/L TSS contour extends 600-m downstream with a 240-m width from plume centerline. The 150-mg/L TSS contour extends 195-m downstream with a 124-m width from plume centerline.

At the 10-cm/sec and 6-cm/sec tidal velocities, a 150-mg/L TSS concentration did not extend past a 400-m downstream transect, and a 240-mg/L TSS did not extend past a 200-m downstream transect.

Compliance with water quality standards on a monthly bases is determined by averaging over both tidal conditions and possible particle distributions. Volume fractions of the borrow material and the assignment of these fractions to the four model particle distributions was discussed in Section 3.3. The cross-sectional area results for the four modeled particle distributions were averaged weighted by the volume fractions of the borrow material. This was performed for the tidal average 6-cm/sec velocity condition. The resulting averaged cross-sectional areas associated with cutterhead dredging from the borrow are provided below.

Cross-Sectional Area (%) for TSS Concentration

Downstream Distance (m)	Monthly Average		Maximum	
	50 mg/L	70 mg/L	150 mg/L	240 mg/L
100	17.6	14.2	6.7	2.1
200	21.2	14.8	1.0	0.0
400	15.7	4.5	0.0	0.0

The maximum cross-sectional areas in the above table for the 50-70-mg/L TSS concentrations associated with monthly average compliance occur at the 200-m downstream transect. Compliance with the NTU limits based upon a 50-mg/L TSS criteria would require a 53-percent reduction in cross-sectional area, and compliance with a 70-mg/L TSS standard would require a 32-percent reduction. Based on the above TSS results, compliance with Maryland's monthly average water quality standard for turbidity (based upon TSS measurements) would require the use of best management practices.

5. Application of DREDGE Model to Constituents

Sediment chemistry data were available at 5 stations within the footprint of the proposed Masonville containment area. Sediment chemistry was performed at multiple depths at most stations resulting in a total of 14 locations (5 in the overburden and 9 in the borrow area). Constituents of concern (COCs) identified in the data included six metals (chromium, copper, lead, mercury, nickel, zinc), PCBs, and nutrients (nitrite+nitrate, total Kjeldahl nitrogen, phosphorus). The data for these COCs and total organic carbon (TOC) are summarized in Table 5-1 for the overburden and Table 5-2 for the borrow. These tables also provide average and maximum values for each constituent.

The DREDGE model applies a constituent concentration to the sediment that is being dredged. A partitioning coefficient (K_d) is used to model the subsequent particulate and dissolved

fractions in the water column. The model includes a database of partitioning coefficients for select metals and octanol-water partitioning coefficients (Kow) for organic contaminants. Constituent concentrations were calculated for the dissolved fraction because the dissolved fraction is bio-available and dissolved concentrations are the fraction of metals that are addressed in the Maryland's water quality standards.

The DREDGE model database included only four of the six metals of concern. Additional metal partitioning coefficients were estimated from the site data by forming the ratio between the sediment and elutriate concentrations. These data are summarized in the following table.

Metal Partitioning Coefficients (L/kg)

Metal	Model Database		Site Data (a)	Used in Model
	pH 7.0	pH 7.5		
Chromium			107,868	100,000
Copper	85,110	139,640	151,042	85,000
Lead	1,148,150	2,290,870	99,344	100,000
Mercury			675,094	600,000
Nickel	52,480	91,200	26,917	27,000
Zinc	14,125	33,113		33,000

- a) Partitioning coefficients calculated as the ratio between sediment and elutriate concentrations.

Partitioning coefficients for metals are a function of pH. At a lower pH, the partitioning coefficient decreases, allowing a larger portion of the constituent to be present in the dissolved fraction. Water chemistry data for the Masonville site provides pH values typically in the 7-8 range. Partitioning coefficients in the above table, calculated for a pH of 7, are considered conservative, in that they would result in higher dissolved concentrations. For use in the model, partitioning coefficients were selected as the lower of either the model database value or the value calculated from the site data. It should be noted that the 1000,000 L/kg value for lead is based on the site data is considered to be abnormally low, and would result in overly conservative (high dissolved) lead concentrations.

For PCBs, the model database provides a Kow of 1,100,000, which is used in conjunction with a total organic carbon (TOC) fraction to yield a partitioning coefficient. Based on site data, a TOC value of 2.49-percent was used for the overburden and a TOC value of 0.34-percent was used for the borrow (Table 5-1 and 5-2). The 0.34-percent TOC for the borrow was conservatively based on 6 of the 8 values.

Partitioning between dissolved and particulate fractions for nutrients from a sediment source term is not commonly performed and appropriate coefficients are not available within the DREDGE model. For example, TKN is dominated by organic nitrogen, which is not readily available as dissolved. Phosphorous may also have a significant organic component. Due to project limitations, the nutrient COCs were modeled as total water column concentrations (particulate + dissolved).

Using the equations in the DREDGE model, predicted dissolved constituent concentrations were calculated corresponding to the TSS scenarios previously presented. All of the constituent calculations were performed for the tidal average 6-cm/sec velocity condition. For clamshell dredging of the overburden, constituent calculations were performed for a single particle distribution. For cutterhead dredging in the borrow and placement during dike construction, calculations were performed for the sand and the soft clay distributions to bracket a range of associated TSS concentrations. For the metals, PCBs, and nutrients other than TKN, the maximum sediment concentration was used as the source term in the model. For TKN, which exhibited greater variability, the average value was used. Tables containing the predicted results for six metals, PCB's and three nutrients are provided in Attachment A.

- Tables A-28/29 Clamshell dredging overburden
- Tables A-30/31 Cutterhead dredging of sand
- Tables A-32/33 Cutterhead dredging of soft clay
- Tables A-34/35 Placement of sand
- Tables A-36/37 Placement of soft clay

Model results for clamshell dredging are vertically averaged over the water column. Tables A-28 and A-29 contain centerline and 50-m and 100-m offsets from the centerline concentrations at distances downstream to 1,000 m. The cutterhead and placement tables provide TSS concentrations at various water column depths along the centerline at distances downstream to 1,000-m.

The highest constituent concentrations are at a near bottom depth. A summary of the near bottom centerline concentrations are provided in Tables 5-3 for clamshell dredging, Table 5-4 for cutterhead dredging, and Table 5-5 for placement during dike construction. These tables also contain the chronic water quality criteria for aquatic life. An examination of Tables 5-3 to 5-5 indicates that all of the predicted constituent concentrations at the closest modeled downstream distance from the discharge point are in compliance with Maryland's saltwater chronic water quality criteria.

References

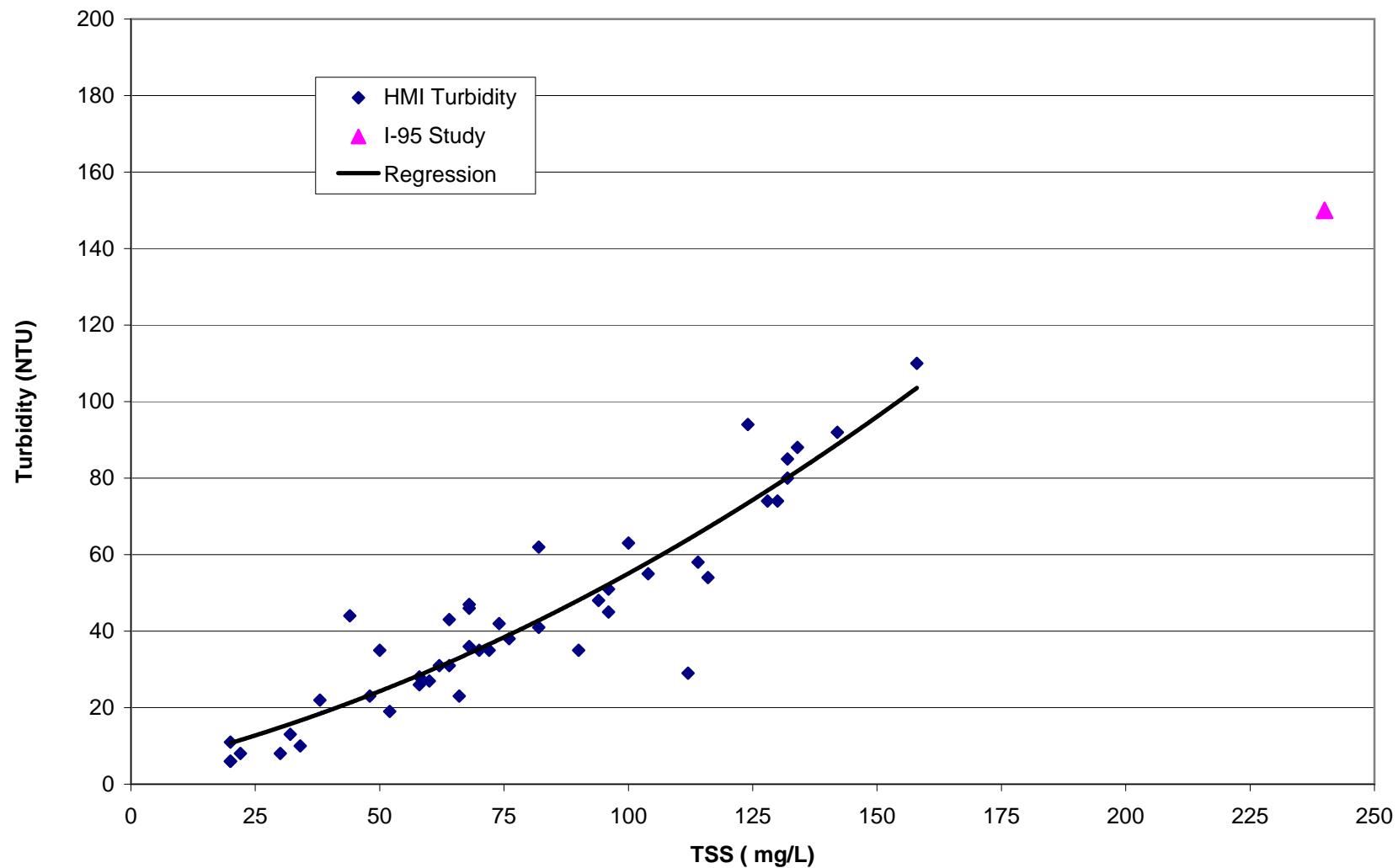
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EA Engineering, Science, and Technology, Inc, 2004, Feasibility Studies of Masonville as a Containment Site for Placement of Harbor Dredged Material: Environmental Conditions-Summer 2004, Prepared for Maryland Port Administration.

Hayes, Donald F., and Chung-Hwan Je, 2000, DREDGE Module User's Guide, Department of Civil and Environmental Engineering, University of Utah.

Figure 1-1 Relationship Between TSS and Turbidity Based on HMI Spillway Data and the I-95 Tunnel Dredge Monitoring Results at 150 NTU



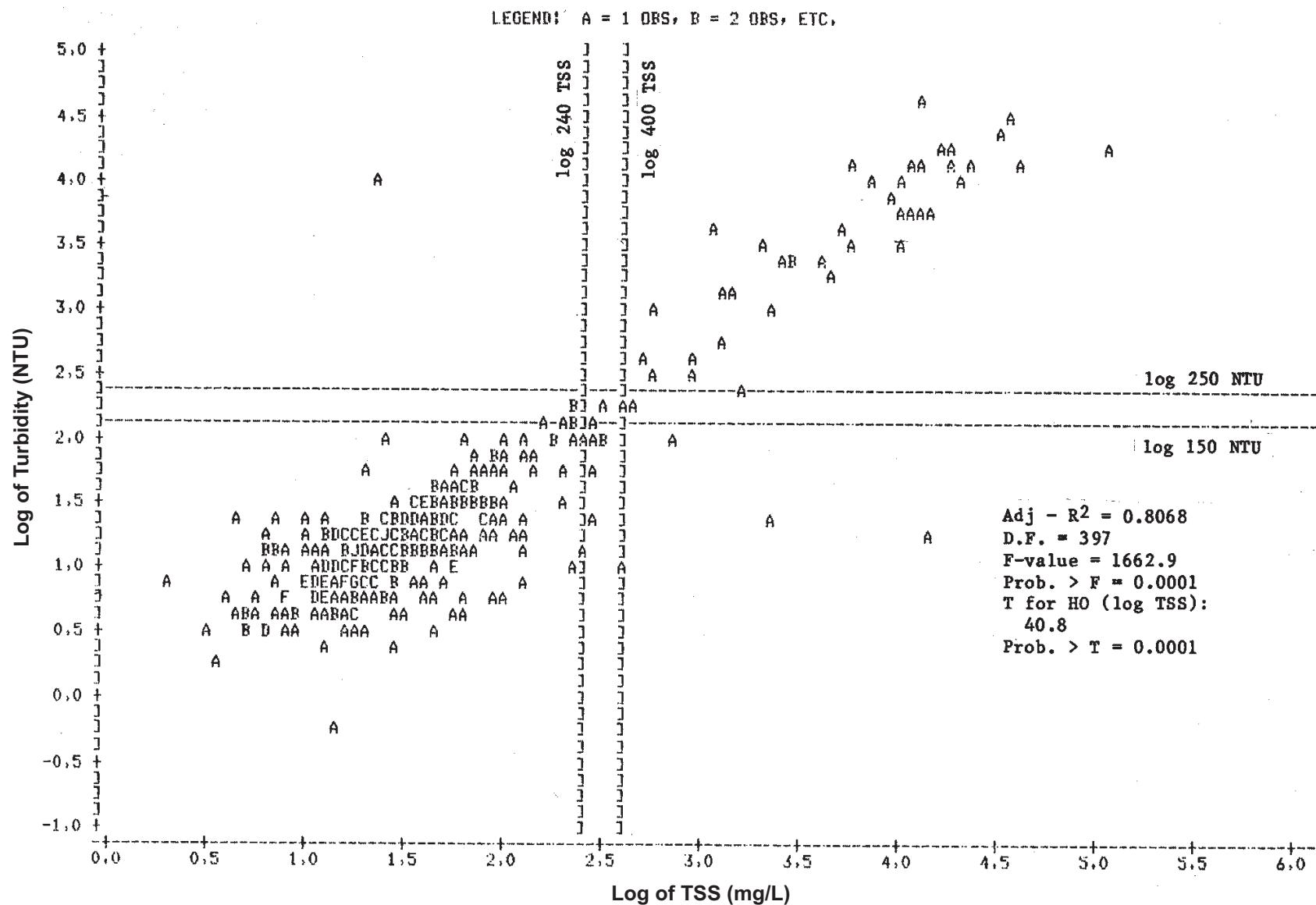


Figure 1-2. Relationship Between Log of Average Turbidity and Log of Total Suspended Solids for All Dredge and Contaminant Site Monitoring Data, I-95 Fort McHenry Tunnel.



Figure 2-1 Predicted Centerline TSS Concentrations for Clamshell Dredging of the Overburden at a Near Bottom (0.5-m) Depth and for Three Tidal Velocities

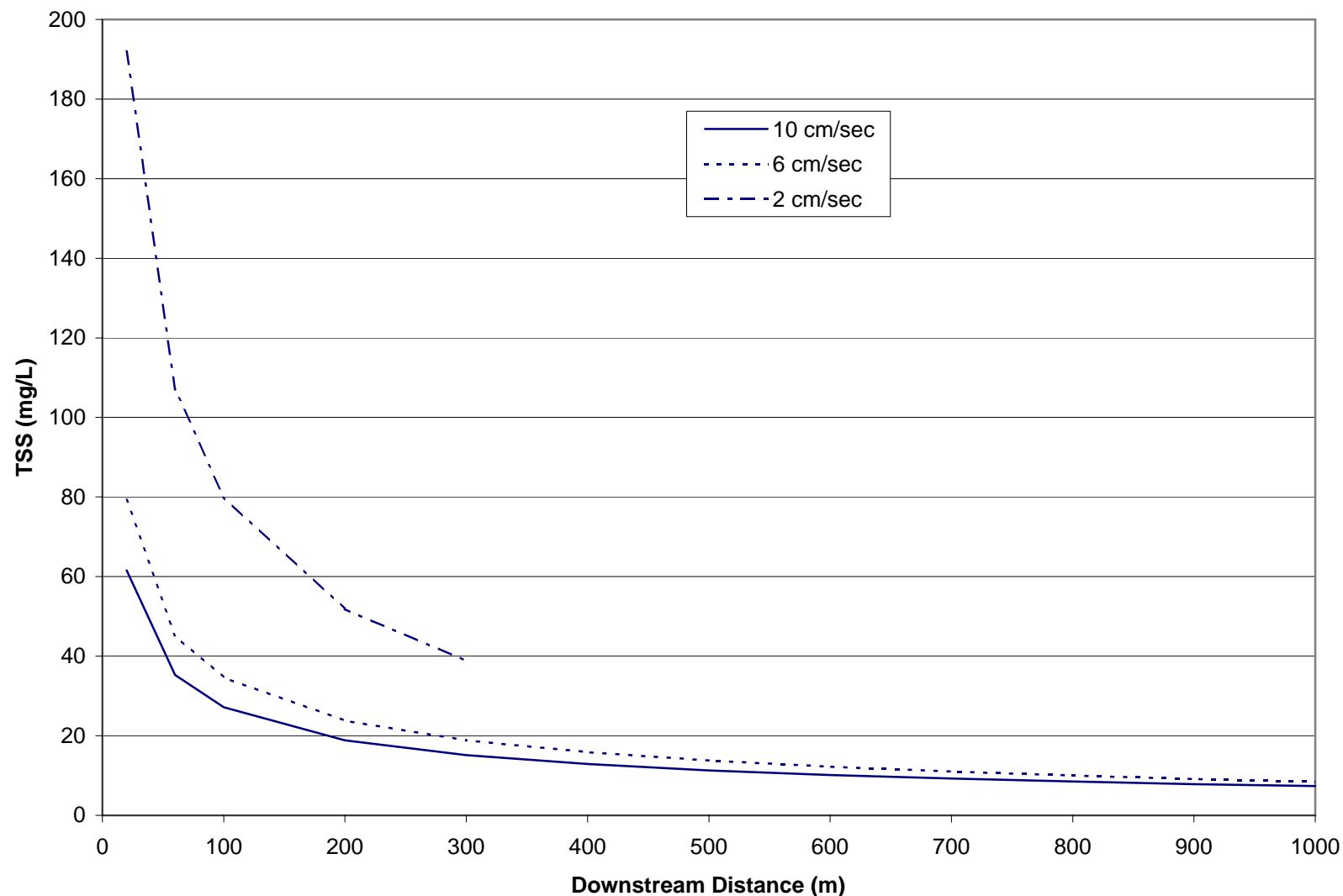


Table 2-1 Particle Size Distribution of Masonville Sediment Samples from the Overburden

	Station					
	01A	05A	06	08	09	Composite
Moisture (%)	155.2	145.7	117.5	136.8	105.8	132.2
Classification	Fraction (%)					
Cobbles	0.0	0.0	0.0	0.0	0.0	0.0
Gravel	1.1	0.0	0.0	0.7	0.0	0.4
Sand	17.8	3.8	7.1	26.7	6.4	12.3
Silt	47.5	66.0	59.5	40.7	67.9	56.3
Clay	33.6	30.2	33.4	31.9	25.7	31.0
Total	100	100	100	100	100	100
Finer (%)	Diameter (mm)					
D85	0.1230	0.0295	0.0324	0.3730	0.0439	0.1204
D60	0.0213	0.0151	0.0152	0.0324	0.0187	0.0205
D50	0.0126	0.0111	0.0114	0.0127	0.0141	0.0124
D30	0.0041	0.0049	0.0041	0.0045	0.0066	0.0048
D15	0.0015	0.0014	0.0016	0.0016	0.0019	0.0016
	Fraction Finer (%)					
0.074 mm	81	96	93	73	94	87.3

Table 2-2 Cross-Sectional Area of Predicted Sediment Plumes Resulting from Clamshell Dredging of the Overburden for a Range of TSS Concentrations

Downstream Distance (m)	Cross-Sectional Area (%)			
	Monthly Average		Maximum	
	50 mg/L	70 mg/L	150 mg/L	240 mg/L
10-cm/sec Tidal Velocity				
20	1.8	0.0	0.0	0.0
60	0.0	0.0	0.0	0.0
100	0.0	0.0	0.0	0.0
6-cm/sec Tidal Velocity				
20	5.2	1.7	0.0	0.0
60	0.0	0.0	0.0	0.0
100	0.0	0.0	0.0	0.0
2-cm/sec Tidal Velocity				
20	11.2	9.6	4.3	0.0
60	14.3	10.7	0.0	0.0
100	14.3	7.4	0.0	0.0
200	5.6	0.0	0.0	0.0

Figure 3-1 Relationship Between Turbidity Generation Unit (TGU) and Material Type

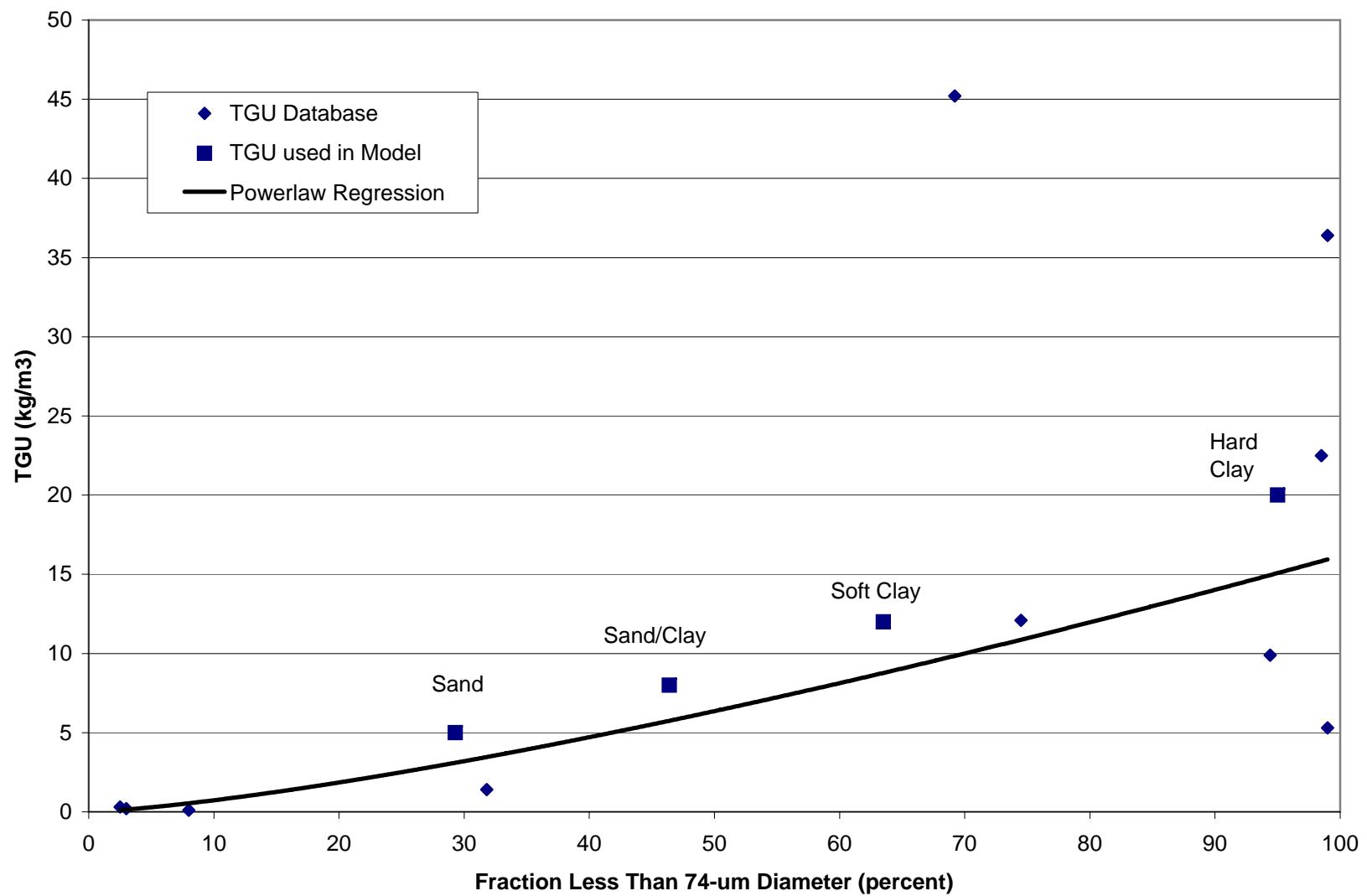
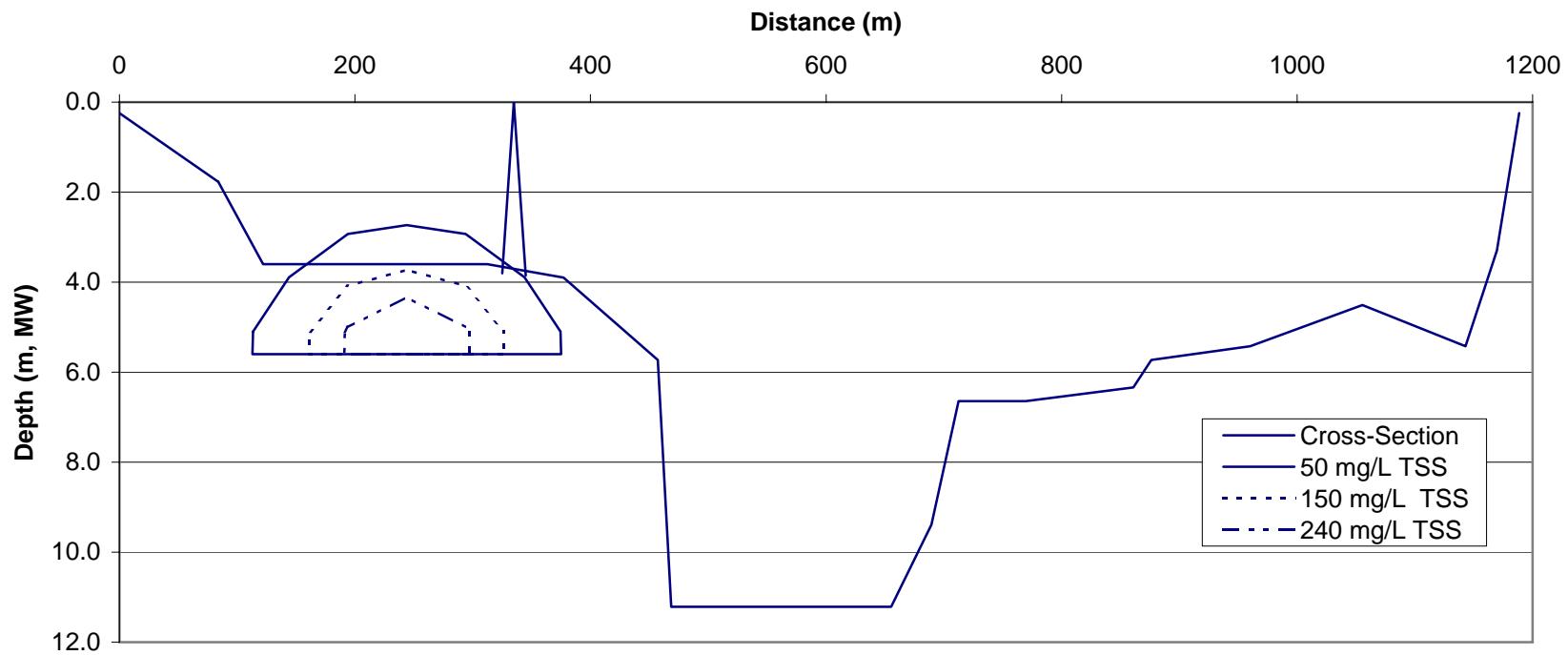


Figure 3-2 Middle Branch Cross-Section at the Masonville Site Displaying TSS Contours for Dredging Sand/Clay (46.4 % Fines) at a 5.6 m depth in the Borrow, (2 cm/sec Velocity, 20-m Downstream Transect)



**Figure 3-3 Near Bottom (0.5-m) TSS Contours for Dredging Soft Clay (63.5 % Fines)
in the Borrow, 6-cm/sec Velocity**

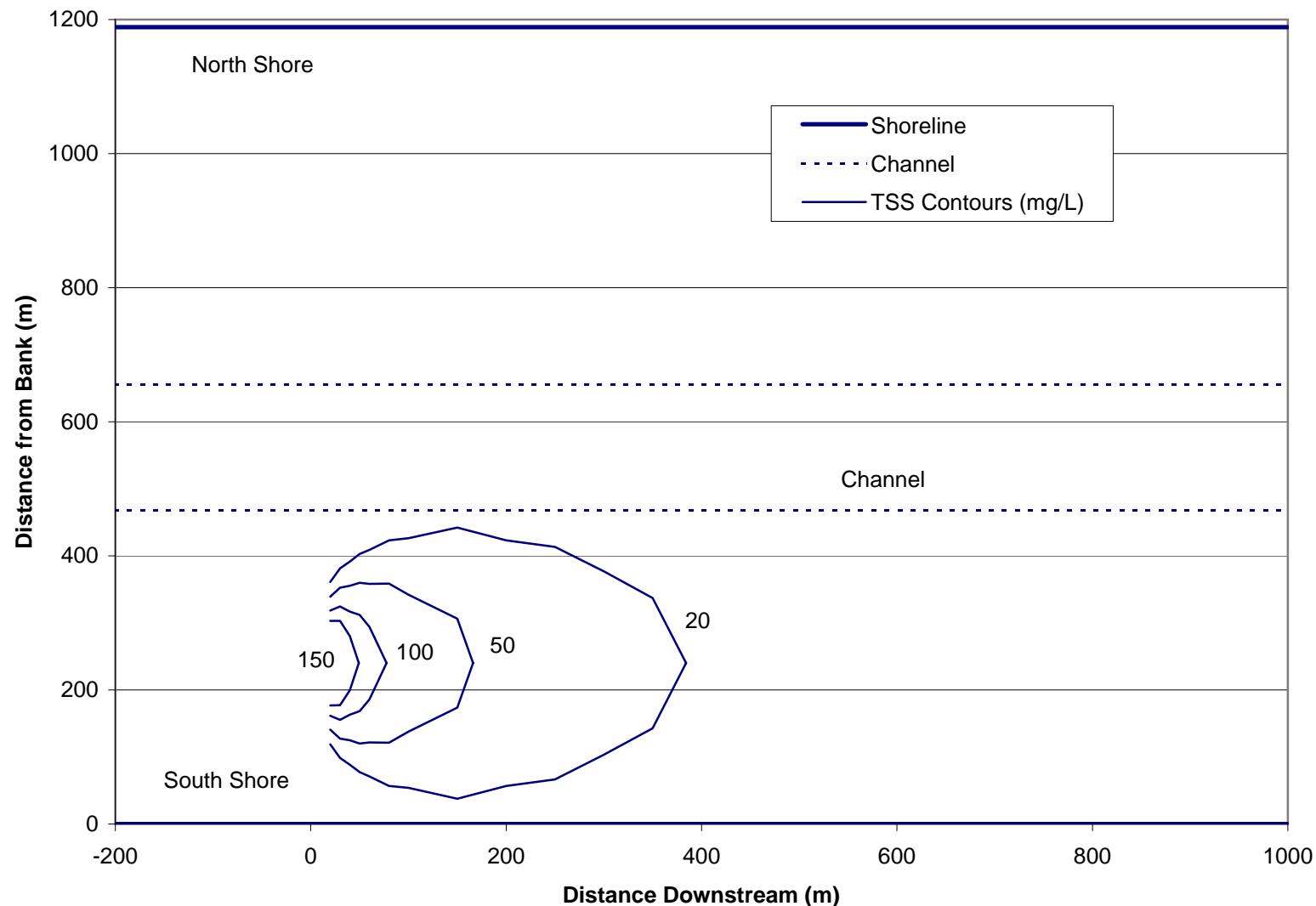


Table 3-1 Particle Size Distributions of Sediment Samples from the Borrow Area for Eight Locations with Sand, a Composite Sample, and the Location with the Highest Clay Content

Particle Size (um)	Sand								Soft Clay
	Location 01A		Loc 05A	Location 06		Loc 08	Location 09		Composite Sample
	8-13 ft	13-25 ft	19-25 ft	26-33 ft	33-43 ft	26-31 ft	13.5-21 ft	21-31 ft	
25000	100	100	100	100	100	100	100	100	100.0
19000	86.9	100	77.3	100	100	100	100	100	95.5
9500	69.7	83.3	70.4	100	100	93.9	87.7	95.8	87.6
4750	58.8	74.6	62.5	100	94.5	90.5	75.4	95.1	81.4
2000	53.4	68.4	57.1	100	85.3	84.8	69.6	93.7	76.5
850	49.6	63.9	52.3	99.9	79.1	76.2	64.0	91.3	72.0
425	42.2	56.3	45.4	99.8	61.8	57.2	52.7	81.0	62.1
250	34.7	46.9	38.7	97.1	38.3	42.4	39.9	62.7	50.1
180	31.9	40.6	33.5	88.9	29.1	36.8	32.4	51.7	43.1
150	30.6	37.9	30.4	82.7	26.2	35.0	28.6	46.8	39.8
75	25.5	30.5	18.2	54.2	20.0	31.2	21.8	33.0	29.3
27.5	22.6	19.5	11.0	34.7	14.7	31.0	16.1	29.9	22.4
18.3	21.1	17.2	9.6	28.9	4.7	27.5	14.8	26.6	18.8
11.0	15.1	15.0	7.8	23.3	4.2	25.2	12.7	23.3	15.8
8.0	10.8	13.3	6.9	20.4	4.2	21.7	10.7	20.0	13.5
5.9	9.2	10.9	5.9	17.6	3.9	19.3	10.1	18.4	11.9
2.9	7.7	8.7	4.9	13.1	2.9	14.6	7.5	14.3	9.2
1.2	6.1	6.3	3.9	10.3	2.4	12.1	5.6	11.0	7.2
Median Dia <74 um (%)	971.1 25.5	307.7 30.5	708.3 18.2	64.8 54.2	337.1 20.0	339.9 31.2	388.1 21.8	169.6 33.0	249.1 29.3
Gravel	41.2	25.4	37.5	0	5.5	9.5	24.6	4.9	18.6
Clay	9.2	10.9	5.9	17.6	3.9	19.3	10.1	18.4	11.9
Silt	16.3	19.6	12.3	36.6	16.2	11.8	11.7	14.6	17.4
Coarse Sand	5.4	6.2	5.4	0	9.2	5.7	5.8	1.4	4.9
Medium Sand	11.2	12.1	11.7	0.2	23.6	27.6	16.9	12.7	14.4
fine Sand	16.7	25.8	27.2	45.6	41.7	26	30.8	48	32.8
Sand (Total)	33.3	44.1	44.3	45.8	74.5	59.3	53.5	62.1	52.1
Percent Solids	57.4	77.8	80.3	75.4	80.6	53.5	70	80.4	71.9
Specific Gravity	2.573	2.708	2.715	2.727	2.696	2.598	2.684	2.731	2.679

Table 3-2 Predicted TSS Concentrations Along the Plume Centerline at 0.5-m and 2-m Heights above the Bottom for Cutterhead Dredging in the Borrow

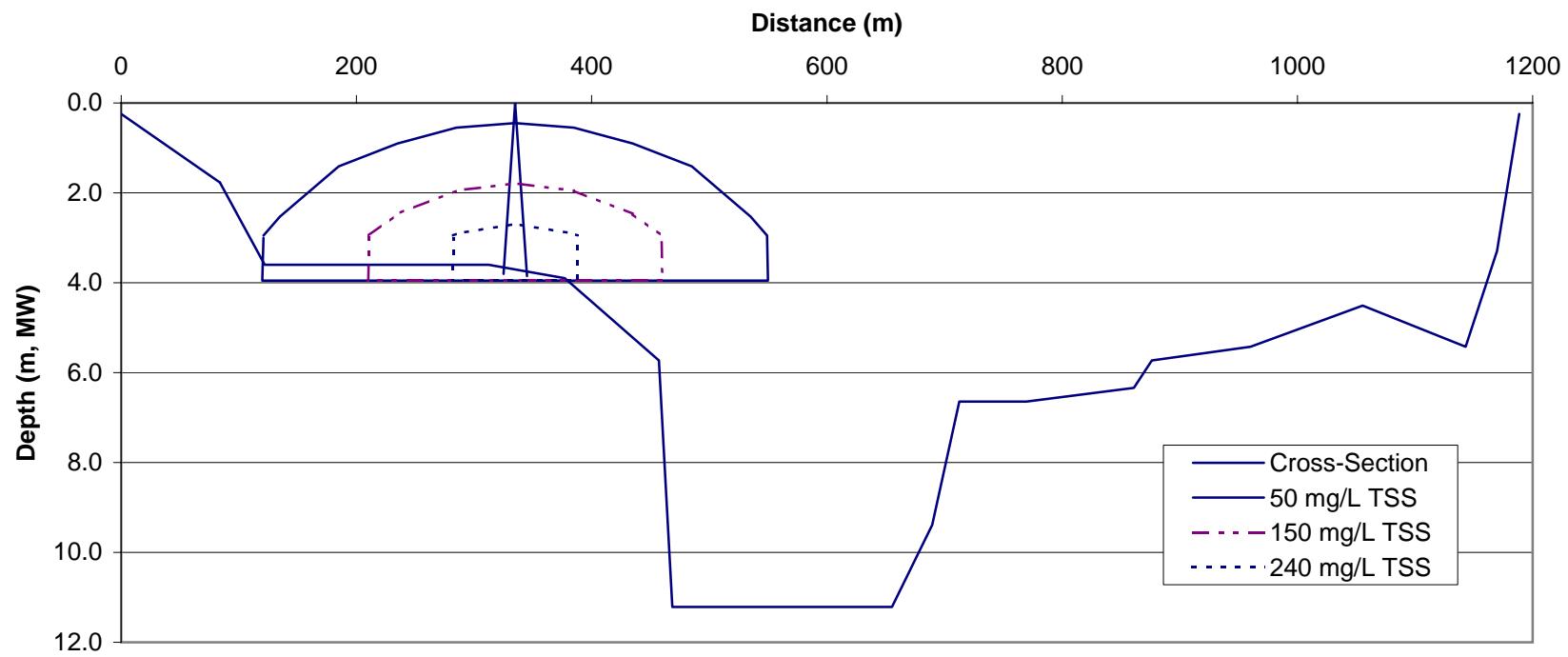
Material	Tidal Velocity (cm/sec)	TSS Concentration (mg/L)						
		0.5-m Near Bottom Height				2-m Height above Bottom		
		Downstream Distance (m)		20	100	200	20	100
Sand	10	115	29.5	15.2	0.5	11.0	9.0	
	6	131	30.3	15.4	7.4	16.4	11.0	
	2	209	43.7	21.9	77.6	34.4	18.9	
Sand/Clay	10	187	48.0	24.8	1.7	18.5	15.3	
	6	212	49.2	25.1	12.5	27.6	18.7	
	2	339	71.3	35.9	131	58.3	32.2	
Soft Clay	10	280	71.8	37.1	2.6	27.9	23.0	
	6	318	74.0	37.7	19.0	41.8	28.2	
	2	508	106.8	53.7	197	87.9	48.6	
Hard Clay	10	180	46.1	23.8	1.7	18.0	14.8	
	6	204	47.3	24.1	12.2	26.8	18.1	
	2	326	68.6	34.5	127	56.6	31.3	

Table 3-3 Cross-Sectional Area of Predicted Sediment Plumes Resulting from Cutterhead Dredging in the Borrow Area
for a Range of TSS Concentrations

Downstream Distance (m)	Cross-Sectional Area (%)				
	Monthly Average		Maximum		
	50 mg/L	70 mg/L	150 mg/L	240 mg/L	
Sand 10 cm/sec (29.3 % Fines)					
20	1.1	0.7	0.0	0.0	
100	0.0	0.0	0.0	0.0	
200	0.0	0.0	0.0	0.0	
Sand 6 cm/sec (29.3 % Fines)					
20	2.2	1.4	0.0	0.0	
100	0.0	0.0	0.0	0.0	
200	0.0	0.0	0.0	0.0	
Sand 2 cm/sec (29.3 % Fines)					
20	5.9	4.4	1.3	0.0	
100	0.0	0.0	0.0	0.0	
200	0.0	0.0	0.0	0.0	
Sand/Clay 10 cm/sec (46.4 % Fines)					
20	2.0	1.4	0.3	0.0	
100	0.0	0.0	0.0	0.0	
200	0.0	0.0	0.0	0.0	
Sand/Clay 6 cm/sec (46.4 % Fines)					
20	3.4	2.6	0.8	0.0	
100	0.0	0.0	0.0	0.0	
200	0.0	0.0	0.0	0.0	
Sand/Clay 2 cm/sec (46.4 % Fines)					
20	8.3	6.8	3.4	1.4	
100	6.7	0.3	0.0	0.0	
200	0.0	0.0	0.0	0.0	

Downstream Distance (m)	Cross-Sectional Area (%)				
	Monthly Average		Maximum		
	50 mg/L	70 mg/L	150 mg/L	240 mg/L	
Soft Clay 10 cm/sec (63.5 % Fines)					
20	2.6	2.1	0.9	0.2	
100	2.3	0.1	0.0	0.0	
200	0.0	0.0	0.0	0.0	
Soft Clay 6 cm/sec (63.5 % Fines)					
20	4.1	3.5	1.8	0.6	
100	3.8	0.6	0.0	0.0	
200	0.0	0.0	0.0	0.0	
Soft Clay 2 cm/sec (63.5 % Fines)					
20	9.7	8.5	4.9	3.2	
100	15.4	0.0	0.0	0.0	
200	2.7	0.0	0.0	0.0	
Hard Clay 10 cm/sec (95 % Fines)					
20	2.0	1.3	0.3	0.0	
100	0.0	0.0	0.0	0.0	
200	0.0	0.0	0.0	0.0	
Hard Clay 6 cm/sec (95 % Fines)					
20	3.3	2.5	0.7	0.0	
100	0.0	0.0	0.0	0.0	
200	0.0	0.0	0.0	0.0	
Hard Clay 2 cm/sec (95 % Fines)					
20	8.1	6.6	3.3	1.2	
100	6.3	1.9	0.0	0.0	
200	0.0	0.0	0.0	0.0	

**Figure 4-1 Middle Branch Cross-Section at the Masonville Site Displaying TSS Contours for Placement of Sand (29.3 % Fines) During Dike Construction,
(6-cm/sec Velocity, 100-m Downstream Transect)**



**Figure 4-2 Near Bottom (1-m) TSS Contours for Placement of Sand (29.3 % Fines)
During Dike Construction, 6-cm/sec Velocity**

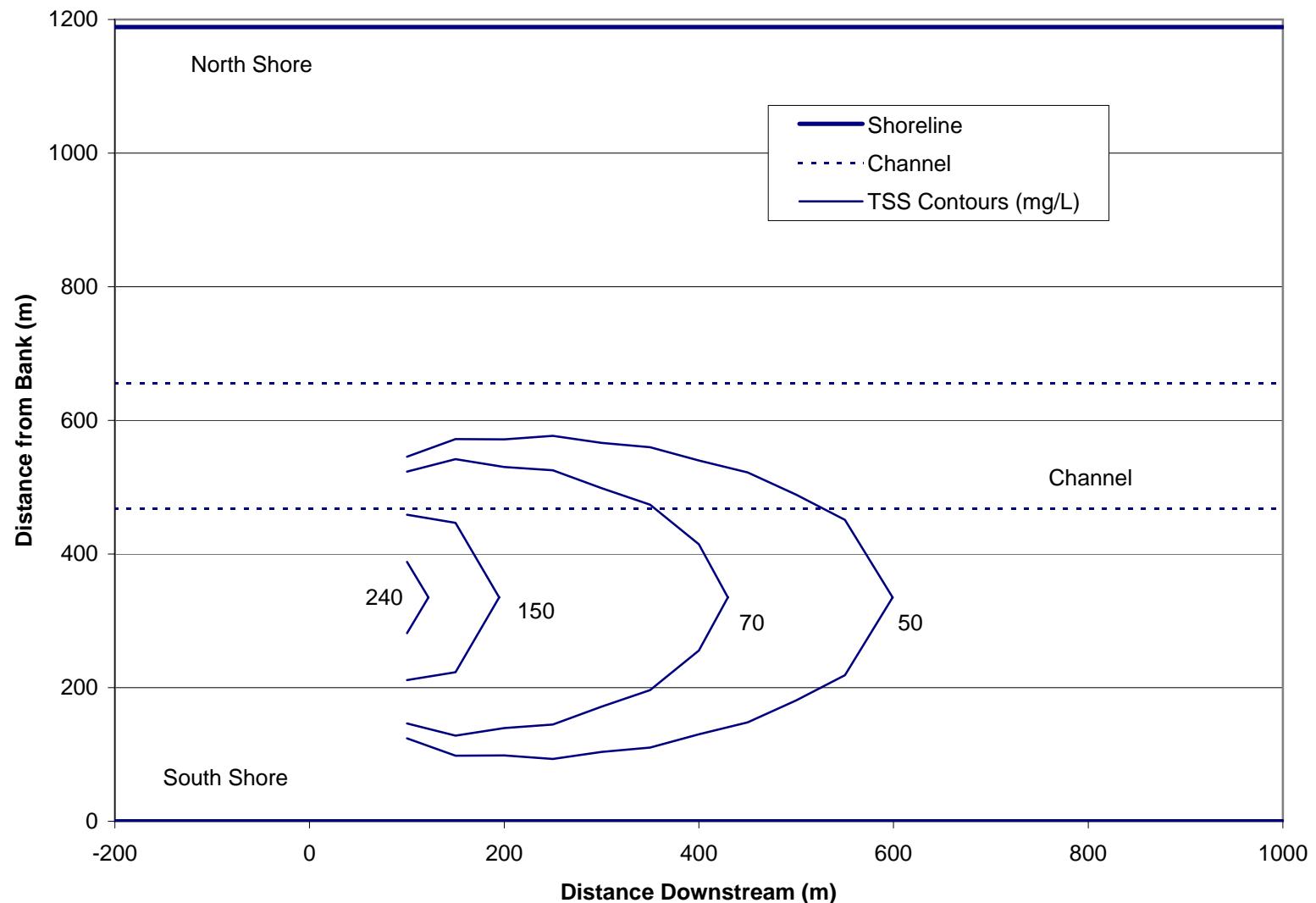


Table 4-1 Determination of Mass Rate of Fines to the Water Column for Placement of Dredge Material During Dike Construction

Sediment	Ambient Velocity (cm/sec)	Mass Removal Rate (kg/sec)	Percent Fines (%)	Mass Rate Fines (kg/sec)	Fines Remaining(a) (%)	Mass Rate to Water Column (kg/sec)
Sand	10	667.7	29.3	195.6	13.5	26.3
Sand	6	667.7	29.3	195.6	13.1	25.6
Sand	2	667.7	29.3	195.6	12.7	24.9
Sand/Clay	10	667.7	46.4	309.8	10.1	31.2
Sand/Clay	6	667.7	46.4	309.8	10.1	31.3
Sand/Clay	2	667.7	46.4	309.8	10.1	31.3
Soft Clay	10	667.7	63.5	424.0	9.3	39.5
Soft Clay	6	667.7	63.5	424.0	9.4	39.9
Soft Clay	2	667.7	63.5	424.0	9.5	40.2
Hard Clay	10	288.0	95.0	82.1(b)	23.4	19.2
Hard Clay	6	288.0	95.0	82.1(b)	22.2	18.2
Hard Clay	2	288.0	95.0	82.1(b)	21.0	17.3

a) Fines remaining after 10-minute STFATE model run.

b) Assume 70-percent clumping (see Section 4.1).

Table 4-2 Predicted TSS Concentrations Along the Plume Centerline at 1.0-m and 3.0-m Heights Above the Bottom for Placement During Dike Construction

Material	Tidal Velocity (cm/sec)	TSS Concentration (mg/L)					
		1-m Near Bottom Height Downstream Distance (m)			3-m Height above Bottom Downstream Distance (m)		
		100	200	400	100	200	400
Sand	10	249	141	74.7	31.4	48.2	42.2
	6	267	144	74.3	75.0	73.5	51.3
	2	404	206		253	157	
Sand/Clay	10	303	171	91.2	40.2	61.9	54.3
	6	336	181	93.9	99.2	97.4	68.2
	2	525	269		345	216	
Soft Clay	10	385	218	116	51.6	79.5	69.8
	6	430	232	120	128	126	88.2
	2	677	347		449	281	
Hard Clay	10	187	106	56.5	25.2	38.8	34.0
	6	196	106	54.9	58.7	57.7	40.4
	2	291	149		194	121	

Table 4-3 Cross-Sectional Area of Predicted Sediment Plumes Resulting from Placement of Dredge Material During Dike Construction for a Range of TSS Concentrations

Downstream Distance (m)	Cross-Sectional Area (%)				
	Monthly Average		Maximum		
	50 mg/L	70 mg/L	150 mg/L	240 mg/L	
Sand 10 cm/sec (29.3% Fines)					
100	10.7	8.6	3.9	0.4	
200	12.9	8.9	0.0	0.0	
400	9.7	2.1	0.0	0.0	
Sand 6 cm/sec (29.3% Fines)					
100	17.3	13.9	6.5	1.8	
200	20.8	14.3	0.0	0.0	
400	14.9	2.8	0.0	0.0	
Sand 2 cm/sec (29.3% Fines)					
100	31.3	28.3	19.2	10.5	
200	36.8	31.4	11.9	0.0	
Sand/Clay 10 cm/sec (46.4% Fines)					
100	12.0	9.8	5.1	2.2	
200	15.4	11.5	2.3	0.0	
400	14.8	7.0	0.0	0.0	
Sand/Clay 6 cm/sec (46.4% Fines)					
100	20.0	16.4	8.9	4.1	
200	25.4	19.4	4.5	0.0	
400	24.7	12.0	0.0	0.0	
Sand/Clay 2 cm/sec (46.4% Fines)					
100	33.8	30.9	23.3	16.5	
200	40.9	36.2	21.9	5.0	

Downstream Distance (m)	Cross-Sectional Area (%)				
	Monthly Average		Maximum		
	50 mg/L	70 mg/L	150 mg/L	240 mg/L	
Soft Clay 10 cm/sec (63.5% Fines)					
100	13.8	11.5	6.7	3.7	
200	18.5	14.4	5.3	0.0	
400	20.7	12.7	0.0	0.0	
Soft Clay 6 cm/sec (63.5% Fines)					
100	22.3	19.1	11.4	6.7	
200	29.1	24.1	9.4	0.0	
400	31.5	21.7	0.0	0.0	
Soft Clay 2 cm/sec (63.5% Fines)					
100	34.3	31.4	25.4	20.4	
200	44.3	39.9	27.7	15.5	
Hard Clay 10 cm/sec (95% Fines)					
100	9.0	7.0	2.1	0.0	
200	9.9	5.8	0.0	0.0	
400	3.6	0.0	0.0	0.0	
Hard Clay 6 cm/sec (95% Fines)					
100	14.5	11.2	3.4	0.0	
200	15.5	9.0	0.0	0.0	
400	4.5	0.0	0.0	0.0	
Hard Clay 2 cm/sec (95% Fines)					
100	28.9	25.2	14.2	4.5	
200	32.2	25.9	0.0	0.0	

Table 5-1 Sediment Chemistry Data at the Masonville Site for Locations in the Overburden

ANALYTE	Units	01A 0-3 ft	01A 3-8	05A 0-19 ft	06 0-26 ft	09 0-13.5 ft	Min	Max	Mean
NO ₂ +NO ₃ as N	mg/kg	0.65	B	4.2			0.65	4.2	2.43
Total Kjeldahl N	mg/kg	5820		4170	1670	2180	1670	5820	3198
Phosphorus	mg/kg	803		469	949	721	601	949	708.6
Chromium, total	mg/kg	188		64.6	92.9	90.2	152	64.6	117.5
Copper	mg/kg	306		146	257	112	156	112	306
lead	mg/kg	351		177	107	E	117	E	351
Mercury	mg/kg	1.9		0.55	0.58	0.38	0.64	0.38	0.81
Nickel	mg/kg	32.3		17.3				17.3	32.3
Zinc	mg/kg	547		171	E	259	E	171	294.6
Total PCBs	ug/kg	246.9		82.4	71.8	109.9	257.4	71.8	153.7
TOC	percent	3.42		1.73	1.93	2.74	3.11	1.73	3.42

B = compound was detected, but below reporting limit

E = reported value is estimated because of the presence of interference

Table 5-2 Sediment Chemistry Data at the Masonville Site for Locations in the Borrow

ANALYTE	Units	01A 8-13 ft	01A 13-25 ft	05A 19-25 ft	05A 25-27.5 ft	06 26-33 ft	06 33-43 ft	08 26-31ft	09 13.5-21ft	09 21-31ft
NO ₂ +NO ₃ as N	mg/kg	0.7 B	0.29 B	0.59 B	0.59 B	0.5 B	0.28 B	0.43 B	1.6	0.52 B
Total Kjeldahl N	mg/kg	2190	216	26100	18700	63.7 U	174 B	35100	480	209
Phosphorus	mg/kg	506	101	145	263	213	84.8	117	304	93.3
Chromium, total	mg/kg	105	29.7	15.9	33.5	21.7	9.1	21.5	30.4	18.8
Copper	mg/kg	177	11.5	12.6	28	12	5.5	11	64.2	11.3
lead	mg/kg	543	4.7	3.6	6.9	4.9	2.3	4.2	33.9	3.6
Mercury	mg/kg	0.92	0.038	0.047	0.06	0.02 B	0.0079 U	0.01 B	0.17	0.023 B
Nickel	mg/kg	17.8	8.6	6.9	17.9	10.4	5	11.8	10.3	4.9
Zinc	mg/kg	245 E	21.5 E	19.7 E	35.3	27.3 E	15.1 E	26.3 E	195 E	16.7
Total PCBs	ug/kg	83.8	3	1.18	0.799	2.05	2.1	1.15	15.3	1.02
TOC	percent	2.69	0.28	0.22	0.25	0.24	0.15	3.53	0.905	

ANALYTE	Units	Min	Max	Mean
NO ₂ +NO ₃ as N	mg/kg	0.28	1.6	0.61
Total Kjeldahl N	mg/kg	63.7	35100	9248
Phosphorus	mg/kg	84.8	506	203.0
Chromium, total	mg/kg	9.1	105	31.73
Copper	mg/kg	5.5	177	37.01
lead	mg/kg	2.3	543	67.46
Mercury	mg/kg	0.0079	0.92	0.14
Nickel	mg/kg	4.9	17.9	10.40
Zinc	mg/kg	15.1	245	66.88
Total PCBs	ug/kg	0.80	83.8	12.27
TOC	percent			1.03

Table 5-3 Calculated Concentrations for Clamshell Dredging of the Overburden at a 0.5-m Near Bottom Depth
 (6-cm/sec Average Tidal Velocity)

Parameter	Units	T/D	Chronic WQ Criteria	Concentration at Downstream Distance (m) Along Plume Centerline							
				20	60	100	200	300	400	500	600
Chromium	ug/L	dissolved	50	1.67	1.54	1.46	1.32	1.23	1.15	1.09	1.03
Copper	ug/L	dissolved	6.1	3.14	2.86	2.69	2.41	2.22	2.07	1.94	1.83
Lead	ug/L	dissolved	8.1	3.12	2.88	2.72	2.47	2.30	2.16	2.04	1.93
Mercury	ug/L	dissolved	0.94	0.0031	0.0031	0.0030	0.0030	0.0029	0.0029	0.0028	0.0028
Nickel	ug/L	dissolved	8.2	0.82	0.66	0.58	0.47	0.40	0.36	0.32	0.30
Zinc	ug/L	dissolved	81	11.99	9.93	8.84	7.29	6.37	5.70	5.19	4.76
PCB's	ng/L	dissolved	30	7.47	4.97	4.12	3.20	2.73	2.43	2.20	2.01
NO ₂ +NO ₃	ug/L	total	--	0.33	0.19	0.15	0.10	0.08	0.07	0.06	0.05
TKN	ug/L	total	--	253.6	144.9	110.7	76.1	60.4	50.8	44.1	39.0
Phosphorus	ug/L	total	--	75.3	43.0	32.8	22.6	17.9	15.1	13.1	11.6

Table 5-4 Calculated Concentrations for Cutterhead Dredging of Sand and Soft Clay from the Borrow at a 0.5-m Near Bottom Depth
(6-cm/sec Average Tidal Velocity)

Cutterhead Dredging of Sand in the Borrow

Parameter	Units	T/D	Chronic WQ Criteria	Concentration at Downstream Distance (m) Along Plume Centerline								
				20	40	60	100	200	300	400	500	600
Chromium	ug/L	dissolved	50	0.98	0.92	0.87	0.79	0.64	0.53	0.46	0.40	0.36
Copper	ug/L	dissolved	6.1	1.91	1.79	1.68	1.50	1.18	0.97	0.82	0.72	0.64
Lead	ug/L	dissolved	8.1	5.04	4.77	4.51	4.08	3.29	2.76	2.36	2.08	1.86
Mercury	ug/L	dissolved	0.94	0.0015	0.0015	0.0015	0.0015	0.0014	0.0013	0.0013	0.0012	0.0012
Nickel	ug/L	dissolved	8.2	0.52	0.44	0.38	0.30	0.19	0.14	0.11	0.10	0.08
Zinc	ug/L	dissolved	81	6.03	5.22	4.60	3.71	2.50	1.88	1.50	1.26	1.09
PCB's	ng/L	dissolved	30	6.35	4.14	3.12	2.10	1.16	0.80	0.61	0.50	0.42
NO ₂ +NO ₃	ug/L	total	--	0.21	0.11	0.08	0.05	0.02	0.02	0.01	0.01	0.01
TKN	ug/L	total	--	1208	1663	455.9	280.2	142.4	95.3	71.2	57.3	48.1
Phosphorus	ug/L	total	--	66.1	36.3	24.9	15.3	7.79	5.21	3.90	3.14	2.63

Cutterhead Dredging of Soft Clay in the Borrow

Parameter	Units	T/D	Chronic WQ Criteria	Concentration at Downstream Distance (m) Along Plume Centerline								
				20	40	60	100	200	300	400	500	600
Chromium	ug/L	dissolved	50	1.02	0.99	0.97	0.93	0.83	0.75	0.69	0.63	0.59
Copper	ug/L	dissolved	6.1	2.01	1.95	1.90	1.80	1.59	1.42	1.29	1.17	1.08
Lead	ug/L	dissolved	8.1	5.27	5.14	5.01	4.78	4.29	3.89	3.56	3.28	3.04
Mercury	ug/L	dissolved	0.94	0.0015	0.0015	0.0015	0.0015	0.0015	0.0014	0.0014	0.0014	0.0014
Nickel	ug/L	dissolved	8.2	0.59	0.55	0.51	0.44	0.33	0.27	0.22	0.19	0.17
Zinc	ug/L	dissolved	81	6.78	6.33	5.93	5.27	4.12	3.38	2.86	2.48	2.19
PCB's	ng/L	dissolved	30	11.67	7.75	6.00	4.24	2.52	1.80	1.40	1.15	0.98
NO ₂ +NO ₃	ug/L	total	--	0.51	0.28	0.19	0.12	0.06	0.04	0.03	0.02	0.02
TKN	ug/L	total	--	2945	1617	1113	684.4	348.7	234.0	175.7	140.6	117.5
Phosphorus	ug/L	total	--	161.1	88.4	60.9	37.4	19.1	12.8	9.61	7.69	6.43

Table 5-5 Calculated Concentrations for Placement of Material Dredged from the Borrow During Dike Construction at a 1-m Near Bottom Depth, (6-cm/sec Average Tidal Velocity)

Placement of Sand During Dike Construction

Parameter	Units	T/D	Chronic WQ Criteria	Concentration at Downstream Distance (m) Along Plume Centerline							
				100	200	300	400	500	600	700	800
Chromium	ug/L	dissolved	50	1.01	0.98	0.95	0.93	0.90	0.87	0.85	0.83
Copper	ug/L	dissolved	6.1	2.00	1.93	1.86	1.80	1.74	1.69	1.63	1.59
Lead	ug/L	dissolved	8.1	5.23	5.08	4.93	4.79	4.65	4.52	4.40	4.29
Mercury	ug/L	dissolved	0.94	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015
Nickel	ug/L	dissolved	8.2	0.58	0.53	0.48	0.44	0.41	0.38	0.36	0.33
Zinc	ug/L	dissolved	81	6.67	6.13	5.67	5.27	4.93	4.62	4.35	4.11
PCB's	ng/L	dissolved	30	10.34	6.78	5.19	4.25	3.62	3.15	2.79	2.50
NO2+NO3	ug/L	total	--	0.43	0.23	0.16	0.12	0.10	0.08	0.07	0.06
TKN	ug/L	total	--	2471	1329	906.3	687.1	553.0	461.5	396.7	346.8
Phosphorus	ug/L	total	--	135.2	72.7	49.6	37.6	30.3	25.2	21.7	19.0

Placement of Soft Clay During Dike Construction

Parameter	Units	T/D	Chronic WQ Criteria	Concentration at Downstream Distance (m) Along Plume Centerline							
				100	200	300	400	500	600	700	800
Chromium	ug/L	dissolved	50	1.03	1.01	0.99	0.97	0.95	0.94	0.92	0.90
Copper	ug/L	dissolved	6.1	2.03	1.98	1.94	1.90	1.86	1.82	1.78	1.75
Lead	ug/L	dissolved	8.1	5.31	5.21	5.11	5.01	4.92	4.84	4.75	4.67
Mercury	ug/L	dissolved	0.94	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015
Nickel	ug/L	dissolved	8.2	0.61	0.57	0.54	0.51	0.48	0.46	0.43	0.41
Zinc	ug/L	dissolved	81	6.94	6.57	6.23	5.93	5.66	5.41	5.18	4.97
PCB's	ng/L	dissolved	30	14.43	9.38	7.24	6.00	5.15	4.54	4.06	3.69
NO2+NO3	ug/L	total	--	0.69	0.37	0.25	0.19	0.16	0.13	0.11	0.10
TKN	ug/L	total	--	3976	2143	1465	1113	896.1	750.9	645.5	566.9
Phosphorus	ug/L	total	--	217.5	117.2	80.2	60.9	49.0	41.1	35.3	31.0

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Table A-1 Predicted TSS Concentrations for Clamshell Dredging of the Overburden, 10-cm/sec Current Velocity

Lateral Distance (m)	TSS Concentration (mg/L) at Downstream Distance (m)											
	20	60	100	200	300	400	500	600	700	800	900	1000
-500	0.0	0.0	0.0	0.0	0.1	0.3	0.5	0.8	1.0	1.2	1.4	1.5
-450	0.0	0.0	0.0	0.0	0.2	0.5	0.9	1.2	1.5	1.7	1.9	2.1
-400	0.0	0.0	0.00	0.1	0.5	1.1	1.5	1.9	2.2	2.4	2.6	2.7
-350	0.0	0.0	0.01	0.4	1.2	1.9	2.4	2.8	3.1	3.3	3.4	3.4
-300	0.0	0.00	0.10	1.1	2.3	3.2	3.7	4.0	4.1	4.2	4.2	4.2
-250	0.00	0.05	0.55	2.7	4.1	4.9	5.2	5.3	5.3	5.2	5.1	5.0
-200	0.00	0.55	2.2	5.4	6.6	6.9	6.9	6.7	6.5	6.2	6.0	5.7
-150	0.05	3.39	6.7	9.3	9.5	9.1	8.5	8.0	7.6	7.1	6.7	6.4
-100	2.71	12.5	14.5	13.8	12.3	11.0	10.0	9.2	8.5	7.9	7.3	6.9
-50	28.2	27.2	23.2	17.4	14.4	12.4	11.0	9.9	9.0	8.3	7.7	7.2
0	61.6	35.3	27.2	18.9	15.1	12.9	11.3	10.2	9.2	8.5	7.9	7.3
50	28.2	27.2	23.2	17.4	14.4	12.4	11.0	9.9	9.0	8.3	7.7	7.2
100	2.71	12.5	14.5	13.8	12.3	11.0	10.0	9.2	8.5	7.9	7.3	6.9
150	0.05	3.39	6.7	9.3	9.5	9.1	8.5	8.0	7.6	7.1	6.7	6.4
200	0.00	0.55	2.2	5.4	6.6	6.9	6.9	6.7	6.5	6.2	6.0	5.7
250	0.00	0.05	0.5	2.7	4.1	4.9	5.2	5.3	5.3	5.2	5.1	5.0
300	0.0	0.00	0.1	1.1	2.3	3.2	3.7	4.0	4.1	4.2	4.2	4.2
350	0.0	0.0	0.0	0.4	1.2	1.9	2.4	2.8	3.1	3.3	3.4	3.4
400	0.0	0.0	0.00	0.1	0.5	1.1	1.5	1.9	2.2	2.4	2.6	2.7
450	0.0	0.0	0.0	0.0	0.2	0.5	0.9	1.2	1.5	1.7	1.9	2.1
500	0.0	0.0	0.0	0.0	0.1	0.3	0.5	0.8	1.0	1.2	1.4	1.5

Table A-2 Predicted TSS Concentrations for Clamshell Dredging of the Overburden, 6-cm/sec Current Velocity

Lateral Distance (m)	TSS Concentration (mg/L) at Downstream Distance (m)											
	20	60	100	200	300	400	500	600	700	800	900	1000
-500	0.0	0.0	0.00	0.2	0.8	1.5	2.1	2.6	2.9	3.1	3.2	3.3
-450	0.0	0.0	0.02	0.5	1.5	2.4	3.0	3.4	3.7	3.9	3.9	3.9
-400	0.0	0.0	0.09	1.2	2.6	3.5	4.2	4.5	4.7	4.7	4.7	4.6
-350	0.0	0.0	0.4	2.4	4.1	5.0	5.5	5.7	5.7	5.6	5.5	5.3
-300	0.0	0.16	1.2	4.4	6.1	6.8	7.0	7.0	6.8	6.5	6.3	6.0
-250	0.00	0.91	3.3	7.4	8.6	8.8	8.6	8.3	7.9	7.5	7.0	6.7
-200	0.04	3.71	7.7	11.2	11.4	10.9	10.2	9.5	8.9	8.3	7.7	7.3
-150	1.17	11.1	14.9	15.6	14.2	12.9	11.6	10.6	9.7	9.0	8.3	7.7
-100	12.2	24.2	23.8	19.7	16.7	14.5	12.8	11.5	10.4	9.5	8.8	8.1
-50	49.6	38.7	31.5	22.7	18.3	15.5	13.5	12.0	10.8	9.9	9.1	8.3
0	79.3	45.3	34.6	23.8	18.9	15.9	13.8	12.2	11.0	10.0	9.1	8.4
50	49.6	38.7	31.5	22.7	18.3	15.5	13.5	12.0	10.8	9.9	9.1	8.3
100	12.2	24.2	23.8	19.7	16.7	14.5	12.8	11.5	10.4	9.5	8.8	8.1
150	1.17	11.1	14.9	15.6	14.2	12.9	11.6	10.6	9.7	9.0	8.3	7.7
200	0.04	3.71	7.7	11.2	11.4	10.9	10.2	9.5	8.9	8.3	7.7	7.3
250	0.00	0.91	3.3	7.4	8.6	8.8	8.6	8.3	7.9	7.5	7.0	6.7
300	0.0	0.16	1.2	4.4	6.1	6.8	7.0	7.0	6.8	6.5	6.3	6.0
350	0.0	0.0	0.4	2.4	4.1	5.0	5.5	5.7	5.7	5.6	5.5	5.3
400	0.0	0.0	0.09	1.2	2.6	3.5	4.2	4.5	4.7	4.7	4.7	4.6
450	0.0	0.0	0.02	0.5	1.5	2.4	3.0	3.4	3.7	3.9	3.9	3.9
500	0.0	0.0	0.00	0.2	0.8	1.5	2.1	2.6	2.9	3.1	3.2	3.3

Table A-3 Predicted TSS Concentrations for Clamshell Dredging of the Overburden, 2-cm/sec Current Velocity

Lateral Distance (m)	TSS Concentration (mg/L) at Downstream Distance (m)											
	20	60	100	200	300	400	500	600	700	800	900	1000
-500	0.0	0.0	0.16	2.3	4.8	6.5	7.2	7.4	7.3	7.0	6.6	6.2
-450	0.0	0.0	0.51	4.1	7.2	8.7	9.2	9.1	8.7	8.1	7.6	6.9
-400	0.0	0.1	1.47	7.0	10.2	11.3	11.3	10.8	10.1	9.3	8.5	7.7
-350	0.0	0.7	3.7	11.2	14.0	14.3	13.7	12.7	11.6	10.5	9.4	8.5
-300	0.0	2.52	8.4	16.8	18.3	17.5	16.1	14.5	13.0	11.6	10.3	9.2
-250	0.08	7.92	16.8	23.7	23.0	20.8	18.5	16.3	14.3	12.6	11.1	9.9
-200	1.29	20.22	29.4	31.5	27.8	24.0	20.7	17.9	15.5	13.5	11.9	10.4
-150	11.53	41.9	45.6	39.1	32.2	26.7	22.5	19.2	16.5	14.3	12.4	10.9
-100	55.0	70.6	62.3	45.8	35.7	28.9	24.0	20.2	17.3	14.9	12.9	11.2
-50	140.5	96.4	75.2	50.3	38.0	30.3	24.9	20.9	17.7	15.2	13.2	11.4
0	192.0	107.0	80.1	51.9	38.8	30.8	25.2	21.1	17.9	15.3	13.3	11.5
50	140.5	96.4	75.2	50.3	38.0	30.3	24.9	20.9	17.7	15.2	13.2	11.4
100	55.0	70.6	62.3	45.8	35.7	28.9	24.0	20.2	17.3	14.9	12.9	11.2
150	11.53	41.9	45.6	39.1	32.2	26.7	22.5	19.2	16.5	14.3	12.4	10.9
200	1.29	20.22	29.4	31.5	27.8	24.0	20.7	17.9	15.5	13.5	11.9	10.4
250	0.08	7.92	16.8	23.7	23.0	20.8	18.5	16.3	14.3	12.6	11.1	9.9
300	0.0	2.52	8.4	16.8	18.3	17.5	16.1	14.5	13.0	11.6	10.3	9.2
350	0.0	0.7	3.7	11.2	14.0	14.3	13.7	12.7	11.6	10.5	9.4	8.5
400	0.0	0.1	1.47	7.0	10.2	11.3	11.3	10.8	10.1	9.3	8.5	7.7
450	0.0	0.0	0.51	4.1	7.2	8.7	9.2	9.1	8.7	8.1	7.6	6.9
500	0.0	0.0	0.16	2.3	4.8	6.5	7.2	7.4	7.3	7.0	6.6	6.2

Table A-4 Predicted TSS Concentrations for Cutterhead Dredging of Sand from the Borrow, 10-cm/sec Current Velocity
 (2,400 yd³/hr Dredging Rate, 29.3 % Fines)

Height (m)	TSS Concentration (mg/L) at Downstream Distance along Plume Centerline (m)												
	20	40	60	100	200	300	400	500	600	700	800	900	1000
3.0	0.0	0.3	1.1	3.0	4.7	4.5	4.1	3.7	3.3	3.0	2.7	2.5	2.3
2.0	0.5	4.1	7.2	11.0	9.0	7.1	5.8	4.9	4.2	3.7	3.3	2.9	2.7
1.0	44.3	41.4	34.0	24.1	13.6	9.5	7.2	5.8	4.9	4.2	3.7	3.3	3.0
0.5	115.1	67.3	47.2	29.5	15.2	10.2	7.7	6.2	5.2	4.4	3.9	3.4	3.1

Height (m)	TSS Concentration (mg/L) at Lateral Distance from Plume Centerline (m)										
	0	50	100	150	200	250	300	350	400	450	500
20-m Downstream											
3.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2.0	1.01	0.46	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1.0	44.3	20.3	1.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.5	115.1	52.7	5.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
100-m Downstream											
3.0	3.0	2.6	1.6	0.7	0.2	0.06	0.01	0.0	0.0	0.0	0.0
2.0	11.0	9.4	5.9	2.7	0.9	0.22	0.04	0.0	0.0	0.0	0.0
1.0	24.1	20.6	12.9	5.9	2.0	0.48	0.09	0.0	0.0	0.0	0.0
0.5	29.5	25.3	15.8	7.2	2.4	0.59	0.11	0.0	0.0	0.0	0.0
200-m Downstream											
3.0	4.7	4.3	3.4	2.3	1.3	0.7	0.28	0.10	0.03	0.0	0.0
2.0	9.0	8.4	6.6	4.5	2.6	1.3	0.54	0.20	0.06	0.0	0.0
1.0	13.6	12.6	10.0	6.7	3.9	1.9	0.82	0.30	0.09	0.0	0.0
0.5	15.2	14.1	11.1	7.5	4.4	2.2	0.91	0.33	0.10	0.0	0.0
400-m Downstream											
3.0	4.1	3.9	3.5	2.9	2.2	1.5	1.0	0.6	0.34	0.17	0.08
2.0	5.8	5.6	4.9	4.1	3.1	2.2	1.4	0.9	0.47	0.24	0.12
1.0	7.2	7.0	6.2	5.1	3.9	2.7	1.8	1.1	0.59	0.31	0.15
0.5	7.7	7.4	6.6	5.4	4.1	2.9	1.9	1.1	0.63	0.33	0.15

Table A-5 Predicted TSS Concentrations for Cutterhead Dredging of Sand from the Borrow, 6-cm/sec Current Velocity
 (2,400 yd³/hr Dredging Rate, 29.3% Fines)

Height (m)	TSS Concentration (mg/L) at Downstream Distance along Plume Centerline (m)												
	20	40	60	100	200	300	400	500	600	700	800	900	1000
3.0	0.17	2.47	5.1	7.5	7.3	6.1	5.1	4.4	3.8	3.4	3.0	2.7	2.5
2.0	7.4	16.7	18.3	16.4	11.0	8.1	6.4	5.3	4.5	3.9	3.4	3.1	2.8
1.0	73.1	53.2	40.2	26.6	14.3	9.8	7.4	6.0	5.0	4.3	3.7	3.3	3.0
0.5	130.6	71.7	49.3	30.3	15.4	10.3	7.7	6.2	5.2	4.4	3.9	3.4	3.1

Height (m)	TSS Concentration (mg/L) at Lateral Distance from Plume Centerline (m)										
	0	50	100	150	200	250	300	350	400	450	500
20-m Downstream											
3.0	0.17	0.11	0.03	0.00	0.00	0.00	0.0	0.0	0.0	0.0	0.0
2.0	7.4	4.7	1.14	0.11	0.00	0.00	0.0	0.0	0.0	0.0	0.0
1.0	73.1	45.8	11.2	1.1	0.04	0.00	0.0	0.0	0.0	0.0	0.0
0.5	130.6	81.8	20.0	1.9	0.07	0.00	0.0	0.0	0.0	0.0	0.0
100-m Downstream											
3.0	7.5	6.8	5.1	3.2	1.67	0.72	0.26	0.08	0.02	0.0	0.0
2.0	16.4	14.9	11.3	7.0	3.7	1.57	0.56	0.17	0.04	0.0	0.0
1.0	26.6	24.2	18.3	11.4	5.9	2.55	0.91	0.27	0.07	0.0	0.0
0.5	30.3	27.6	20.8	13.0	6.8	2.91	1.04	0.31	0.08	0.0	0.0
200-m Downstream											
3.0	7.3	7.0	6.1	4.8	3.5	2.3	1.36	0.74	0.37	0.16	0.07
2.0	11.0	10.5	9.1	7.2	5.2	3.4	2.04	1.11	0.55	0.25	0.10
1.0	14.3	13.7	11.9	9.4	6.8	4.4	2.65	1.44	0.71	0.32	0.13
0.5	15.4	14.7	12.8	10.1	7.3	4.8	2.85	1.55	0.77	0.35	0.14
400-m Downstream											
3.0	5.1	5.0	4.7	4.1	3.5	2.8	2.2	1.62	1.14	0.77	0.49
2.0	6.4	6.2	5.8	5.2	4.4	3.6	2.7	2.03	1.43	0.96	0.61
1.0	7.4	7.2	6.7	6.0	5.1	4.1	3.2	2.35	1.65	1.11	0.71
0.5	7.7	7.6	7.1	6.3	5.3	4.3	3.3	2.46	1.73	1.16	0.74

Table A-6 Predicted TSS Concentrations for Cutterhead Dredging of Sand from the Borrow, 2-cm/sec Current Velocity
 (2,400 yd³/hr Dredging Rate, 29.3 % Fines)

Height (m)	TSS Concentration (mg/L) at Downstream Distance along Plume Centerline (m)										
	20	40	60	100	200	300	400	500	600	700	800
3.0	21.5	33.0	32.0	25.8	16.1	11.5	8.9	7.2	6.1	5.2	4.6
2.0	77.6	63.9	50.3	34.4	18.9	12.9	9.8	7.9	6.6	5.6	4.9
1.0	170.1	96.3	66.8	41.4	21.1	14.1	10.5	8.4	7.0	5.9	5.2
0.5	208.8	107.6	72.4	43.7	21.9	14.5	10.8	8.6	7.1	6.1	5.3
Height (m)	TSS Concentration (mg/L) at Lateral Distance from Plume Centerline (m)										
	0	50	100	150	200	250	300	350	400	450	500
20-m Downstream											
3.0	21.5	15.7	6.2	1.3	0.15	0.01	0.00	0.0	0.0	0.0	0.0
2.0	77.6	56.8	22.2	4.7	0.52	0.03	0.00	0.0	0.0	0.0	0.0
1.0	170.1	124.5	48.7	10.2	1.15	0.07	0.00	0.0	0.0	0.0	0.0
0.5	208.8	152.8	59.8	12.5	1.41	0.08	0.00	0.0	0.0	0.0	0.0
100-m Downstream											
3.0	25.8	24.3	20.1	14.7	9.5	5.4	2.7	1.2	0.47	0.16	0.05
2.0	34.4	32.3	26.8	19.6	12.6	7.2	3.6	1.6	0.63	0.22	0.07
1.0	41.4	38.9	32.2	23.6	15.2	8.7	4.4	1.9	0.76	0.26	0.08
0.5	43.7	41.0	34.0	24.9	16.1	9.2	4.6	2.0	0.80	0.28	0.08
200-m Downstream											
3.0	16.1	15.6	14.2	12.1	9.8	7.4	5.2	3.5	2.2	1.3	0.71
2.0	18.9	18.3	16.7	14.2	11.5	8.6	6.1	4.1	2.6	1.5	0.83
1.0	21.1	20.4	18.6	15.9	12.8	9.6	6.8	4.6	2.9	1.7	0.93
0.5	21.9	21.2	19.3	16.5	13.3	10.0	7.1	4.7	3.0	1.7	0.96
400-m Downstream											
3.0	8.9	8.8	8.4	7.7	6.9	6.0	5.1	4.1	3.3	2.5	1.9
2.0	9.8	9.6	9.2	8.5	7.6	6.6	5.6	4.6	3.6	2.8	2.1
1.0	10.5	10.4	9.9	9.2	8.2	7.1	6.0	4.9	3.9	3.0	2.2
0.5	10.8	10.7	10.2	9.4	8.4	7.3	6.2	5.0	4.0	3.1	2.3

Table A-7 Predicted TSS Concentrations for Cutterhead Dredging of Sand/Clay from the Borrow, 10-cm/sec Current Velocity
 (2,400 yd³/hr Dredging Rate, 46.4 % Fines)

Height (m)	TSS Concentration (mg/L) at Downstream Distance along Plume Centerline (m)												
	20	40	60	100	200	300	400	500	600	700	800	900	1000
3.0	0.00	0.45	2.0	5.3	8.1	7.9	7.1	6.4	5.7	5.2	4.7	4.3	4.0
2.0	1.70	10.3	15.9	18.5	15.3	12.0	9.8	8.2	7.1	6.2	5.6	5.0	4.6
1.0	72.8	68.0	55.9	39.6	22.4	15.6	11.9	9.7	8.1	7.0	6.2	5.5	5.0
0.5	186.9	109.3	76.7	48.0	24.8	16.7	12.6	10.1	8.4	7.2	6.3	5.6	5.1

Height (m)	TSS Concentration (mg/L) at Lateral Distance from Plume Centerline (m)										
	0	50	100	150	200	250	300	350	400	450	500
20-m Downstream											
3.0	0.00	0.00	0.00	0.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2.0	1.7	0.78	0.08	0.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1.0	72.8	33.4	3.2	0.06	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.5	186.9	85.6	8.2	0.17	0.0	0.0	0.0	0.0	0.0	0.0	0.0
100-m Downstream											
3.0	5.3	4.5	2.8	1.3	0.43	0.11	0.02	0.00	0.00	0.0	0.0
2.0	18.5	15.8	9.9	4.5	1.5	0.37	0.07	0.01	0.00	0.0	0.0
1.0	39.6	33.9	21.2	9.7	3.3	0.80	0.14	0.02	0.00	0.0	0.0
0.5	48.0	41.1	25.7	11.8	3.9	0.97	0.17	0.02	0.00	0.0	0.0
200-m Downstream											
3.0	8.1	7.5	5.9	4.0	2.3	1.15	0.49	0.18	0.06	0.01	0.00
2.0	15.3	14.1	11.2	7.6	4.4	2.2	0.92	0.33	0.10	0.03	0.01
1.0	22.4	20.7	16.4	11.1	6.4	3.2	1.35	0.49	0.15	0.04	0.01
0.5	24.8	22.9	18.1	12.3	7.1	3.5	1.49	0.54	0.17	0.04	0.01
400-m Downstream											
3.0	7.1	6.8	6.1	5.0	3.8	2.7	1.7	1.05	0.58	0.30	0.14
2.0	9.8	9.4	8.4	6.9	5.2	3.7	2.4	1.45	0.81	0.41	0.20
1.0	11.9	11.5	10.2	8.4	6.4	4.5	2.9	1.76	0.98	0.50	0.24
0.5	12.6	12.1	10.8	8.8	6.7	4.7	3.1	1.85	1.03	0.53	0.25

Table A-8 Predicted TSS Concentrations for Cutterhead Dredging of Sand/Clay from the Borrow, 6-cm/sec Current Velocity
 (2,400 yd³/hr Dredging Rate, 46.4% Fines)

Height (m)	TSS Concentration (mg/L) at Downstream Distance along Plume Centerline (m)												
	20	40	60	100	200	300	400	500	600	700	800	900	1000
3.0	0.29	4.3	8.8	12.9	12.7	10.6	8.9	7.6	6.6	5.9	5.3	4.8	4.4
2.0	12.5	28.1	30.9	27.6	18.7	13.7	10.8	8.9	7.6	6.6	5.8	5.2	4.7
1.0	120.1	87.4	66.0	43.8	23.6	16.1	12.2	9.9	8.3	7.1	6.2	5.5	5.0
0.5	211.8	116.3	80.0	49.2	25.1	16.8	12.6	10.1	8.5	7.3	6.3	5.6	5.1

Height (m)	TSS Concentration (mg/L) at Lateral Distance from Plume Centerline (m)										
	0	50	100	150	200	250	300	350	400	450	500
20-m Downstream											
3.0	0.29	0.18	0.05	0.00	0.00	0.00	0.0	0.0	0.0	0.0	0.0
2.0	12.5	7.8	1.92	0.19	0.01	0.00	0.0	0.0	0.0	0.0	0.0
1.0	120.1	75.2	18.4	1.8	0.07	0.00	0.0	0.0	0.0	0.0	0.0
0.5	211.8	132.5	32.5	3.1	0.12	0.00	0.0	0.0	0.0	0.0	0.0
100-m Downstream											
3.0	12.9	11.8	8.9	5.6	2.89	1.24	0.44	0.13	0.03	0.0	0.0
2.0	27.6	25.2	19.0	11.9	6.2	2.65	0.95	0.28	0.07	0.0	0.0
1.0	43.8	39.8	30.1	18.8	9.8	4.2	1.50	0.44	0.11	0.0	0.0
0.5	49.2	44.8	33.8	21.2	11.0	4.7	1.68	0.50	0.12	0.0	0.0
200-m Downstream											
3.0	12.7	12.1	10.5	8.3	6.0	3.9	2.35	1.28	0.63	0.29	0.12
2.0	18.7	17.8	15.5	12.2	8.8	5.8	3.45	1.88	0.93	0.42	0.17
1.0	23.6	22.5	19.5	15.5	11.1	7.3	4.36	2.37	1.17	0.53	0.22
0.5	25.1	23.9	20.8	16.4	11.8	7.8	4.64	2.52	1.25	0.56	0.23
400-m Downstream											
3.0	8.9	8.7	8.1	7.2	6.1	5.0	3.8	2.8	1.99	1.33	0.85
2.0	10.8	10.6	9.9	8.8	7.4	6.0	4.7	3.4	2.42	1.62	1.04
1.0	12.2	12.0	11.1	9.9	8.4	6.8	5.3	3.9	2.73	1.83	1.17
0.5	12.6	12.4	11.5	10.2	8.7	7.0	5.4	4.0	2.82	1.89	1.21

Table A-9 Predicted TSS Concentrations for Cutterhead Dredging of Sand/Clay from the Borrow, 2-cm/sec Current Velocity
 (2,400 yd³/hr Dredging Rate, 46.4 % Fines)

Height (m)	TSS Concentration (mg/L) at Downstream Distance along Plume Centerline (m)										
	20	40	60	100	200	300	400	500	600	700	800
4.0	6.4	23.6	30.7	31.4	23.4	17.8	14.3	11.9	10.2	8.9	7.9
3.0	37.2	57.3	55.5	45.0	28.1	20.2	15.7	12.9	10.9	9.4	8.3
2.0	131.0	108.0	85.0	58.3	32.2	22.2	16.9	13.7	11.5	9.9	8.7
1.0	280.0	158.6	110.2	68.4	35.0	23.5	17.7	14.2	11.9	10.2	8.9
0.5	339.4	175.1	117.9	71.3	35.9	24.0	18.0	14.4	12.0	10.3	9.0

Height (m)	TSS Concentration (mg/L) at Lateral Distance from Plume Centerline (m)										
	0	50	100	150	200	250	300	350	400	450	500
20-m Downstream											
4.0	6.4	4.7	1.8	0.4	0.04	0.00	0.0	0.0	0.00	0.00	0.00
3.0	37.2	27.2	10.7	2.2	0.25	0.02	0.0	0.0	0.00	0.00	0.00
2.0	131.0	95.9	37.5	7.9	0.88	0.05	0.0	0.0	0.00	0.00	0.00
1.0	280.0	204.9	80.2	16.8	1.89	0.11	0.0	0.0	0.00	0.00	0.00
0.5	339.4	248.3	97.2	20.4	2.29	0.14	0.0	0.0	0.00	0.00	0.00
100-m Downstream											
4.0	31.4	29.5	24.4	17.9	11.5	6.6	3.3	1.5	0.58	0.20	0.06
3.0	45.0	42.2	35.0	25.6	16.5	9.4	4.7	2.1	0.82	0.29	0.09
2.0	58.3	54.8	45.4	33.2	21.4	12.2	6.1	2.7	1.07	0.37	0.11
1.0	68.4	64.2	53.3	39.0	25.2	14.3	7.2	3.2	1.25	0.43	0.13
0.5	71.3	67.0	55.5	40.6	26.2	15.0	7.5	3.3	1.31	0.45	0.14
200-m Downstream											
3.0	28.1	27.3	24.8	21.2	17.1	12.9	9.1	6.1	3.8	2.2	1.2
2.0	32.2	31.2	28.4	24.3	19.5	14.7	10.5	7.0	4.4	2.6	1.4
1.0	35.0	34.0	30.9	26.4	21.3	16.0	11.4	7.6	4.7	2.8	1.5
0.5	35.9	34.8	31.7	27.1	21.8	16.4	11.6	7.8	4.9	2.9	1.6
400-m Downstream											
3.0	15.7	15.5	14.8	13.7	12.3	10.6	9.0	7.3	5.8	4.4	3.3
2.0	16.9	16.6	15.9	14.7	13.2	11.4	9.6	7.9	6.2	4.8	3.5
1.0	17.7	17.4	16.6	15.4	13.8	12.0	10.1	8.2	6.5	5.0	3.7
0.5	18.0	17.7	16.9	15.6	14.0	12.2	10.2	8.4	6.6	5.1	3.8

Table A-10 Predicted TSS Concentrations for Cutterhead Dredging of Soft Clay from the Borrow, 10-cm/sec Current Velocity
 (2,400 yd³/hr Dredging Rate, 63.5 % Fines)

Height (m)	TSS Concentration (mg/L) at Downstream Distance along Plume Centerline (m)												
	20	40	60	100	200	300	400	500	600	700	800	900	1000
3.0	0.01	0.68	3.0	8.0	12.3	11.9	10.8	9.6	8.7	7.8	7.1	6.5	6.0
2.0	2.56	15.6	23.9	27.9	23.0	18.1	14.8	12.4	10.7	9.4	8.4	7.5	6.9
1.0	109.3	102.1	83.8	59.4	33.7	23.4	17.9	14.5	12.2	10.5	9.2	8.2	7.4
0.5	279.8	163.5	114.8	71.8	37.1	25.0	18.8	15.1	12.6	10.8	9.5	8.4	7.6

Height (m)	TSS Concentration (mg/L) at Lateral Distance from Plume Centerline (m)										
	0	50	100	150	200	250	300	350	400	450	500
20-m Downstream											
3.0	0.01	0.00	0.00	0.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2.0	2.6	1.17	0.11	0.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1.0	109.3	50.0	4.8	0.10	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.5	279.8	128.1	12.3	0.25	0.0	0.0	0.0	0.0	0.0	0.0	0.0
100-m Downstream											
3.0	8.0	6.8	4.3	2.0	0.65	0.16	0.03	0.00	0.00	0.0	0.0
2.0	27.9	23.9	14.9	6.8	2.3	0.56	0.10	0.01	0.00	0.0	0.0
1.0	59.4	50.8	31.8	14.6	4.9	1.19	0.21	0.03	0.00	0.0	0.0
0.5	71.8	61.4	38.5	17.6	5.9	1.45	0.26	0.03	0.00	0.0	0.0
200-m Downstream											
3.0	12.3	11.3	9.0	6.1	3.5	1.74	0.74	0.27	0.08	0.02	0.01
2.0	23.0	21.3	16.8	11.4	6.6	3.3	1.38	0.50	0.15	0.04	0.01
1.0	33.7	31.1	24.6	16.7	9.6	4.8	2.02	0.73	0.23	0.06	0.01
0.5	37.1	34.3	27.1	18.3	10.6	5.3	2.23	0.81	0.25	0.07	0.01
400-m Downstream											
3.0	10.8	10.3	9.2	7.6	5.8	4.1	2.6	1.59	0.88	0.45	0.22
2.0	14.8	14.2	12.6	10.4	7.9	5.6	3.6	2.18	1.21	0.62	0.30
1.0	17.9	17.2	15.3	12.6	9.6	6.7	4.4	2.64	1.47	0.76	0.36
0.5	18.8	18.1	16.1	13.2	10.1	7.1	4.6	2.78	1.55	0.79	0.38

Table A-11 Predicted TSS Concentrations for Cutterhead Dredging of Soft Clay from the Borrow, 6-cm/sec Current Velocity
 (2,400 yd³/hr Dredging Rate, 63.5% Fines)

Height (m)	TSS Concentration (mg/L) at Downstream Distance along Plume Centerline (m)												
	20	40	60	100	200	300	400	500	600	700	800	900	1000
3.0	0.44	6.5	13.3	19.7	19.3	16.1	13.5	11.6	10.1	8.9	8.0	7.3	6.6
2.0	19.0	42.5	46.7	41.8	28.2	20.8	16.4	13.5	11.5	10.0	8.8	7.9	7.2
1.0	181.0	131.6	99.5	65.9	35.5	24.3	18.4	14.9	12.5	10.7	9.4	8.4	7.5
0.5	318.4	174.8	120.3	74.0	37.7	25.3	19.0	15.2	12.7	10.9	9.6	8.5	7.6

Height (m)	TSS Concentration (mg/L) at Lateral Distance from Plume Centerline (m)										
	0	50	100	150	200	250	300	350	400	450	500
20-m Downstream											
3.0	0.44	0.28	0.07	0.01	0.00	0.00	0.0	0.0	0.0	0.0	0.0
2.0	19.0	11.9	2.91	0.28	0.01	0.00	0.0	0.0	0.0	0.0	0.0
1.0	181.0	113.2	27.8	2.7	0.10	0.00	0.0	0.0	0.0	0.0	0.0
0.5	318.4	199.2	48.8	4.7	0.18	0.00	0.0	0.0	0.0	0.0	0.0
100-m Downstream											
3.0	19.7	17.9	13.5	8.5	4.39	1.89	0.67	0.20	0.05	0.0	0.0
2.0	41.8	38.1	28.8	18.0	9.3	4.0	1.43	0.42	0.10	0.0	0.0
1.0	65.9	60.0	45.3	28.4	14.7	6.3	2.26	0.67	0.16	0.0	0.0
0.5	74.0	67.4	50.8	31.8	16.5	7.1	2.53	0.75	0.18	0.0	0.0
200-m Downstream											
3.0	19.3	18.4	16.0	12.7	9.1	6.0	3.6	1.94	0.96	0.43	0.18
2.0	28.2	26.9	23.4	18.5	13.3	8.7	5.2	2.84	1.41	0.63	0.26
1.0	35.5	33.9	29.5	23.3	16.8	11.0	6.6	3.57	1.77	0.80	0.33
0.5	37.7	36.0	31.2	24.7	17.8	11.7	7.0	3.79	1.88	0.85	0.35
400-m Downstream											
3.0	13.5	13.2	12.3	11.0	9.3	7.5	5.8	4.3	3.02	2.03	1.30
2.0	16.4	16.0	14.9	13.3	11.3	9.1	7.1	5.2	3.66	2.46	1.57
1.0	18.4	18.0	16.8	14.9	12.7	10.3	7.9	5.9	4.12	2.76	1.77
0.5	19.0	18.6	17.3	15.4	13.1	10.6	8.2	6.0	4.24	2.85	1.83

Table A-12 Predicted TSS Concentrations for Cutterhead Dredging of Soft Clay from the Borrow, 2-cm/sec Current Velocity
 (2,400 yd³/hr Dredging Rate, 63.5 % Fines)

Height (m)	TSS Concentration (mg/L) at Downstream Distance along Plume Centerline (m)										
	20	40	60	100	200	300	400	500	600	700	800
4.0	9.7	36.0	46.7	47.7	35.6	27.1	21.7	18.1	15.5	13.5	12.0
3.0	56.3	86.7	84.1	68.1	42.6	30.6	23.8	19.5	16.5	14.3	12.6
2.0	197.4	162.8	128.2	87.9	48.6	33.5	25.5	20.6	17.3	14.9	13.1
1.0	420.1	238.0	165.4	102.6	52.6	35.4	26.6	21.3	17.8	15.3	13.4
0.5	508.0	262.0	176.5	106.8	53.7	35.9	26.9	21.6	18.0	15.4	13.5

Height (m)	TSS Concentration (mg/L) at Lateral Distance from Plume Centerline (m)										
	0	50	100	150	200	250	300	350	400	450	500
20-m Downstream											
3.0	56.3	41.2	16.1	3.4	0.38	0.02	0.00	0.0	0.0	0.0	0.0
2.0	197.4	144.5	56.6	11.9	1.33	0.08	0.00	0.0	0.0	0.0	0.0
1.0	420.1	307.3	120.4	25.2	2.8	0.17	0.01	0.0	0.0	0.0	0.0
0.5	508.0	371.6	145.5	30.5	3.4	0.21	0.01	0.0	0.0	0.0	0.0
100-m Downstream											
4.0	47.7	44.9	37.2	27.2	17.6	10.0	5.0	2.2	0.87	0.30	0.09
3.0	68.1	64.0	53.0	38.8	25.1	14.3	7.2	3.2	1.25	0.43	0.13
2.0	87.9	82.5	68.4	50.1	32.3	18.4	9.3	4.1	1.6	0.56	0.17
1.0	102.6	96.4	79.9	58.5	37.7	21.5	10.8	4.8	1.9	0.65	0.20
0.5	106.8	100.3	83.2	60.9	39.3	22.4	11.3	5.0	2.0	0.68	0.21
200-m Downstream											
3.0	42.6	41.3	37.6	32.2	25.9	19.5	13.8	9.2	5.8	3.4	1.9
2.0	48.6	47.1	42.8	36.6	29.4	22.2	15.8	10.5	6.6	3.9	2.1
1.0	52.6	51.0	46.4	39.7	31.9	24.1	17.1	11.4	7.1	4.2	2.3
0.5	53.7	52.1	47.4	40.6	32.6	24.6	17.4	11.6	7.3	4.3	2.4
400-m Downstream											
3.0	23.8	23.5	22.4	20.7	18.6	16.1	13.6	11.1	8.8	6.7	5.0
2.0	25.5	25.1	24.0	22.2	19.9	17.3	14.5	11.9	9.4	7.2	5.3
1.0	26.6	26.2	25.0	23.1	20.7	18.0	15.2	12.4	9.8	7.5	5.6
0.5	26.9	26.5	25.3	23.4	21.0	18.2	15.4	12.5	9.9	7.6	5.6

Table A-13 Predicted TSS Concentrations for Cutterhead Dredging of Hard Clay from the Borrow, 10-cm/sec Current Velocity
 (920 yd³/hr Dredging Rate, 95 % Fines)

Height (m)	TSS Concentration (mg/L) at Downstream Distance along Plume Centerline (m)												
	20	40	60	100	200	300	400	500	600	700	800	900	1000
3.0	0.00	0.44	1.9	5.1	7.9	7.7	6.9	6.2	5.6	5.0	4.6	4.2	3.9
2.0	1.65	10.0	15.4	18.0	14.8	11.7	9.5	8.0	6.9	6.1	5.4	4.9	4.4
1.0	70.2	65.6	53.9	38.2	21.6	15.0	11.5	9.3	7.8	6.8	5.9	5.3	4.8
0.5	179.7	105.0	73.8	46.1	23.8	16.0	12.1	9.7	8.1	7.0	6.1	5.4	4.9

Height (m)	TSS Concentration (mg/L) at Lateral Distance from Plume Centerline (m)										
	0	50	100	150	200	250	300	350	400	450	500
20-m Downstream											
3.0	0.00	0.00	0.00	0.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2.0	1.65	0.75	0.07	0.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1.0	70.2	32.2	3.1	0.06	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.5	179.7	82.3	7.9	0.16	0.0	0.0	0.0	0.0	0.0	0.0	0.0
100-m Downstream											
3.0	5.1	4.4	2.7	1.26	0.42	0.10	0.02	0.00	0.00	0.0	0.0
2.0	18.0	15.4	9.6	4.4	1.5	0.36	0.07	0.01	0.00	0.0	0.0
1.0	38.2	32.7	20.4	9.4	3.1	0.77	0.14	0.02	0.00	0.0	0.0
0.5	46.1	39.5	24.7	11.3	3.8	0.93	0.17	0.02	0.00	0.0	0.0
200-m Downstream											
3.0	7.9	7.3	5.8	3.9	2.3	1.12	0.48	0.17	0.05	0.01	0.00
2.0	14.8	13.7	10.8	7.3	4.2	2.1	0.89	0.32	0.10	0.03	0.01
1.0	21.6	20.0	15.8	10.7	6.2	3.1	1.30	0.47	0.15	0.04	0.01
0.5	23.8	22.0	17.4	11.8	6.8	3.4	1.43	0.52	0.16	0.04	0.01
400-m Downstream											
3.0	6.9	6.7	5.9	4.9	3.7	2.6	1.7	1.02	0.57	0.29	0.14
2.0	9.5	9.1	8.1	6.7	5.1	3.6	2.3	1.40	0.78	0.40	0.19
1.0	11.5	11.1	9.8	8.1	6.2	4.3	2.8	1.70	0.95	0.49	0.23
0.5	12.1	11.6	10.3	8.5	6.5	4.6	3.0	1.78	0.99	0.51	0.24

Table A-14 Predicted TSS Concentrations for Cutterhead Dredging of Hard Clay from the Borrow, 6-cm/sec Current Velocity
 (920 yd³/hr Dredging Rate, 95% Fines)

Height (m)	TSS Concentration (mg/L) at Downstream Distance along Plume Centerline (m)												
	20	40	60	100	200	300	400	500	600	700	800	900	1000
3.0	0.29	4.2	8.6	12.6	12.4	10.3	8.7	7.4	6.5	5.7	5.1	4.7	4.3
2.0	12.2	27.3	30.0	26.8	18.1	13.3	10.5	8.7	7.4	6.4	5.7	5.1	4.6
1.0	115.8	84.2	63.6	42.2	22.7	15.5	11.8	9.5	8.0	6.9	6.0	5.4	4.8
0.5	203.6	111.8	76.9	47.3	24.1	16.2	12.2	9.7	8.1	7.0	6.1	5.4	4.9
Height (m)	TSS Concentration (mg/L) at Lateral Distance from Plume Centerline (m)												
	0	50	100	150	200	250	300	350	400	450	500		
20-m Downstream													
3.0	0.29	0.18	0.04	0.00	0.00	0.00	0.0	0.0	0.0	0.0	0.0	0.0	
2.0	12.2	7.6	1.87	0.18	0.01	0.00	0.0	0.0	0.0	0.0	0.0	0.0	
1.0	115.8	72.5	17.8	1.7	0.06	0.00	0.0	0.0	0.0	0.0	0.0	0.0	
0.5	203.6	127.4	31.2	3.0	0.11	0.00	0.0	0.0	0.0	0.0	0.0	0.0	
100-m Downstream													
3.0	12.6	11.5	8.7	5.4	2.82	1.21	0.43	0.13	0.03	0.0	0.0	0.0	
2.0	26.8	24.4	18.4	11.5	6.0	2.6	0.92	0.27	0.07	0.0	0.0	0.0	
1.0	42.2	38.4	29.0	18.1	9.4	4.0	1.44	0.43	0.11	0.0	0.0	0.0	
0.5	47.3	43.1	32.5	20.3	10.6	4.5	1.62	0.48	0.12	0.0	0.0	0.0	
200-m Downstream													
3.0	12.4	11.8	10.3	8.1	5.9	3.8	2.3	1.25	0.62	0.28	0.11		
2.0	18.1	17.3	15.0	11.9	8.5	5.6	3.3	1.82	0.90	0.41	0.17		
1.0	22.7	21.7	18.9	14.9	10.7	7.0	4.2	2.29	1.13	0.51	0.21		
0.5	24.1	23.0	20.0	15.8	11.4	7.5	4.5	2.42	1.20	0.54	0.22		
400-m Downstream													
3.0	8.7	8.5	7.9	7.0	6.0	4.8	3.7	2.8	1.94	1.30	0.83		
2.0	10.5	10.3	9.6	8.5	7.2	5.9	4.5	3.3	2.35	1.58	1.01		
1.0	11.8	11.5	10.7	9.6	8.1	6.6	5.1	3.7	2.63	1.77	1.13		
0.5	12.2	11.9	11.1	9.8	8.4	6.8	5.2	3.9	2.71	1.82	1.17		

Table A-15 Predicted TSS Concentrations for Cutterhead Dredging of Hard Clay from the Borrow, 2-cm/sec Current Velocity
 (920 yd³/hr Dredging Rate, 95 % Fines)

Height (m)	TSS Concentration (mg/L) at Downstream Distance along Plume Centerline (m)										
	20	40	60	100	200	300	400	500	600	700	800
3.0	36.3	55.9	54.2	43.9	27.5	19.7	15.4	12.6	10.6	9.2	8.1
2.0	127.1	104.8	82.5	56.6	31.3	21.5	16.4	13.3	11.1	9.6	8.4
1.0	270.0	153.0	106.3	65.9	33.8	22.7	17.1	13.7	11.5	9.8	8.6
0.5	326.2	168.3	113.4	68.6	34.5	23.1	17.3	13.9	11.5	9.9	8.7

Height (m)	TSS Concentration (mg/L) at Lateral Distance from Plume Centerline (m)										
	0	50	100	150	200	250	300	350	400	450	500
20-m Downstream											
3.0	36.3	26.5	10.4	2.2	0.24	0.02	0.0	0.0	0.0	0.0	0.0
2.0	127.1	93.0	36.4	7.6	0.86	0.05	0.0	0.0	0.0	0.0	0.0
1.0	270.0	197.5	77.3	16.2	1.8	0.11	0.0	0.0	0.0	0.0	0.0
0.5	326.2	238.7	93.5	19.6	2.2	0.13	0.0	0.0	0.0	0.0	0.0
100-m Downstream											
3.0	43.9	41.2	34.2	25.0	16.1	9.2	4.6	2.05	0.80	0.28	0.09
2.0	56.6	53.1	44.1	32.2	20.8	11.9	6.0	2.65	1.04	0.36	0.11
1.0	65.9	62.0	51.4	37.6	24.3	13.8	7.0	3.08	1.21	0.42	0.13
0.5	68.6	64.4	53.4	39.1	25.2	14.4	7.2	3.21	1.26	0.43	0.13
200-m Downstream											
3.0	27.5	26.6	24.3	20.7	16.7	12.6	8.9	5.9	3.7	2.19	1.21
2.0	31.3	30.3	27.6	23.6	19.0	14.3	10.1	6.8	4.2	2.49	1.37
1.0	33.8	32.8	29.8	25.5	20.5	15.5	11.0	7.3	4.6	2.69	1.49
0.5	34.5	33.4	30.5	26.0	20.9	15.8	11.2	7.5	4.7	2.75	1.52
400-m Downstream											
3.0	15.4	15.1	14.4	13.4	12.0	10.4	8.8	7.2	5.7	4.3	3.22
2.0	16.4	16.2	15.4	14.3	12.8	11.1	9.4	7.6	6.0	4.6	3.44
1.0	17.1	16.8	16.1	14.9	13.3	11.6	9.8	8.0	6.3	4.8	3.59
0.5	17.3	17.0	16.3	15.0	13.5	11.7	9.9	8.0	6.4	4.9	3.63

Table A-16 Predicted TSS Concentrations for Placement of Sand During Dike Construction, 10-cm/sec Current Velocity
 (2,400 yd³/hr Dredging Rate, 29.3% Fines)

Height (m)	TSS Concentration (mg/L) at Downstream Distance along Plume Centerline (m)									
	100	200	300	400	500	600	700	800	900	1000
4.0	5.3	19.4	25.2	26.3	25.7	24.4	23.0	21.6	20.3	19.0
3.0	31.4	48.2	46.7	42.2	37.8	33.9	30.6	27.8	25.5	23.5
2.0	113.3	93.3	73.4	59.8	50.2	43.2	37.9	33.7	30.3	27.6
1.0	248.5	140.6	97.6	74.7	60.4	50.7	43.7	38.3	34.1	30.8

Height (m)	TSS Concentration (mg/L) at Lateral Distance from Plume Centerline (m)										
	0	50	100	150	200	250	300	350	400	450	500
100-m Downstream											
4.0	5.3	4.5	2.8	1.29	0.43	0.11	0.02	0.00	0.00	0.0	0.0
3.0	31.4	26.8	16.8	7.7	2.6	0.63	0.11	0.02	0.00	0.0	0.0
2.0	113.3	96.9	60.7	27.8	9.3	2.28	0.41	0.05	0.01	0.0	0.0
1.0	248.5	212.5	133.0	60.9	20.4	5.00	0.90	0.12	0.01	0.0	0.0
200-m Downstream											
4.0	19.4	18.0	14.2	9.6	5.6	2.8	1.17	0.42	0.13	0.03	0.01
3.0	48.2	44.6	35.3	23.9	13.8	6.8	2.9	1.05	0.33	0.09	0.02
2.0	93.3	86.3	68.3	46.2	26.7	13.2	5.6	2.03	0.63	0.17	0.04
1.0	140.6	130.0	102.9	69.6	40.3	19.9	8.4	3.06	0.95	0.25	0.06
400-m Downstream											
4.0	26.3	25.3	22.5	18.5	14.1	9.9	6.5	3.9	2.2	1.1	0.53
3.0	42.2	40.6	36.1	29.7	22.6	15.9	10.3	6.2	3.5	1.8	0.85
2.0	59.8	57.5	51.1	42.0	32.0	22.5	14.6	8.8	4.9	2.5	1.20
1.0	74.7	71.8	63.9	52.5	40.0	28.1	18.3	11.0	6.1	3.2	1.50

Table A-17 Predicted TSS Concentrations for Placement of Sand During Dike Construction, 6-cm/sec Current Velocity
 (2,400 yd³/hr Dredging Rate, 29.3% Fines)

Height (m)	TSS Concentration (mg/L) at Downstream Distance along Plume Centerline (m)									
	100	200	300	400	500	600	700	800	900	1000
4.0	25.4	42.0	41.7	38.1	34.3	30.9	28.0	25.5	23.4	21.6
3.0	75.0	73.5	61.3	51.3	43.8	38.1	33.7	30.1	27.2	24.8
2.0	164.5	110.8	81.5	64.1	52.7	44.7	38.8	34.3	30.7	27.7
1.0	267.2	143.7	98.0	74.3	59.8	49.9	42.9	37.5	33.4	30.0

Height (m)	TSS Concentration (mg/L) at Lateral Distance from Plume Centerline (m)										
	0	50	100	150	200	250	300	350	400	450	500
100-m Downstream											
4.0	25.4	23.1	17.4	10.9	5.7	2.4	0.87	0.26	0.06	0.01	0.0
3.0	75.0	68.3	51.6	32.3	16.7	7.2	2.6	0.76	0.19	0.04	0.0
2.0	164.5	149.8	113.1	70.7	36.7	15.8	5.6	1.66	0.41	0.08	0.0
1.0	267.2	243.3	183.6	114.9	59.6	25.6	9.1	2.70	0.66	0.14	0.0
200-m Downstream											
4.0	42.0	40.1	34.8	27.5	19.8	13.0	7.8	4.2	2.1	0.94	0.39
3.0	73.5	70.2	61.0	48.2	34.7	22.8	13.6	7.4	3.7	1.7	0.68
2.0	110.8	105.7	91.9	72.7	52.3	34.3	20.5	11.1	5.5	2.5	1.02
1.0	143.7	137.1	119.1	94.2	67.9	44.5	26.6	14.5	7.2	3.2	1.32
400-m Downstream											
4.0	38.1	37.2	34.7	30.9	26.2	21.2	16.4	12.1	8.5	5.7	3.7
3.0	51.3	50.1	46.7	41.6	35.3	28.6	22.1	16.3	11.4	7.7	4.9
2.0	64.1	62.6	58.4	51.9	44.1	35.7	27.6	20.3	14.3	9.6	6.2
1.0	74.3	72.6	67.6	60.2	51.1	41.3	32.0	23.6	16.6	11.1	7.1

Table A-18 Predicted TSS Concentrations for Placement of Sand During Dike Construction, 2-cm/sec Current Velocity
 (2,400 yd³/hr Dredging Rate, 29.3% Fines)

Height (m)	TSS Concentration (mg/L) at Downstream Distance along Plume Centerline (m)									
	100	200	300	400	500	600	700	800	900	1000
4.0	172.0	127.5	96.5	76.9	63.7	54.1	47.0	41.5	37.1	33.4
3.0	252.8	157.3	112.3	86.9	70.7	59.4	51.2	44.9	39.9	35.9
2.0	336.1	184.6	126.5	95.8	77.0	64.2	54.9	47.9	42.5	38.1
1.0	404.4	206.1	137.7	103.1	82.1	68.2	58.1	50.6	44.7	40.0

Height (m)	TSS Concentration (mg/L) at Lateral Distance from Plume Centerline (m)										
	0	50	100	150	200	250	300	350	400	450	500
100-m Downstream											
4.0	172.0	161.6	133.9	98.0	63.3	36.1	18.1	8.0	3.2	1.1	0.33
3.0	252.8	237.4	196.9	144.0	93.0	53.0	26.6	11.8	4.6	1.6	0.49
2.0	336.1	315.7	261.8	191.5	123.6	70.5	35.4	15.7	6.2	2.1	0.65
1.0	404.4	379.9	315.0	230.4	148.8	84.8	42.6	18.9	7.4	2.6	0.78
200-m Downstream											
4.0	127.5	123.6	112.5	96.2	77.3	58.4	41.4	27.6	17.3	10.1	5.6
3.0	157.3	152.5	138.8	118.7	95.4	72.0	51.1	34.0	21.3	12.5	6.9
2.0	184.6	178.9	162.9	139.3	112.0	84.5	59.9	39.9	25.0	14.7	8.1
1.0	206.1	199.7	181.8	155.5	125.0	94.3	66.9	44.6	27.9	16.4	9.1
400-m Downstream											
4.0	76.9	75.7	72.3	66.8	59.9	52.0	43.8	35.8	28.3	21.7	16.1
3.0	86.9	85.6	81.7	75.5	67.7	58.8	49.5	40.4	32.0	24.5	18.2
2.0	95.8	94.4	90.0	83.3	74.6	64.9	54.6	44.6	35.3	27.0	20.1
1.0	103.1	101.5	96.8	89.5	80.3	69.7	58.7	47.9	37.9	29.1	21.6

Table A-19 Predicted TSS Concentrations for Placement of Sand/Clay During Dike Construction, 10-cm/sec Current Velocity
 (2,400 yd³/hr Dredging Rate, 46.4% Fines)

Height (m)	TSS Concentration (mg/L) at Downstream Distance along Plume Centerline (m)									
	100	200	300	400	500	600	700	800	900	1000
4.0	6.9	25.5	33.2	34.7	33.9	32.3	30.4	28.6	26.9	25.3
3.0	40.2	61.9	60.0	54.3	48.6	43.6	39.5	35.9	33.0	30.4
2.0	141.6	116.7	91.9	74.9	63.0	54.3	47.6	42.4	38.2	34.8
1.0	302.5	171.4	119.1	91.2	73.9	62.1	53.5	47.0	41.9	37.9

Height (m)	TSS Concentration (mg/L) at Lateral Distance from Plume Centerline (m)										
	0	50	100	150	200	250	300	350	400	450	500
100-m Downstream											
4.0	6.9	5.9	3.7	1.70	0.57	0.14	0.03	0.00	0.00	0.0	0.0
3.0	40.2	34.4	21.5	9.8	3.3	0.81	0.15	0.02	0.00	0.0	0.0
2.0	141.6	121.1	75.8	34.7	11.6	2.8	0.51	0.07	0.01	0.0	0.0
1.0	302.5	258.8	161.9	74.1	24.8	6.1	1.09	0.14	0.01	0.0	0.0
200-m Downstream											
4.0	25.5	23.6	18.7	12.6	7.3	3.6	1.53	0.56	0.17	0.05	0.01
3.0	61.9	57.2	45.3	30.6	17.7	8.8	3.7	1.3	0.42	0.11	0.03
2.0	116.7	107.9	85.4	57.8	33.4	16.5	7.0	2.5	0.79	0.21	0.05
1.0	171.4	158.5	125.4	84.8	49.1	24.3	10.3	3.7	1.16	0.31	0.07
400-m Downstream											
4.0	34.7	33.4	29.7	24.4	18.6	13.1	8.5	5.1	2.8	1.47	0.70
3.0	54.3	52.2	46.4	38.2	29.1	20.4	13.3	8.0	4.5	2.3	1.09
2.0	74.9	72.0	64.1	52.7	40.1	28.2	18.4	11.0	6.1	3.2	1.51
1.0	91.2	87.7	78.0	64.2	48.8	34.3	22.4	13.5	7.5	3.9	1.84

Table A-20 Predicted TSS Concentrations for Placement of Sand/Clay During Dike Construction, 6-cm/sec Current Velocity
 (2,400 yd³/hr Dredging Rate, 46.4% Fines)

Height (m)	TSS Concentration (mg/L) at Downstream Distance along Plume Centerline (m)									
	100	200	300	400	500	600	700	800	900	1000
4.0	34.4	57.1	56.8	52.0	46.9	42.3	38.4	35.1	32.2	29.8
3.0	99.2	97.4	81.3	68.2	58.4	50.9	45.0	40.4	36.6	33.4
2.0	212.0	143.1	105.4	83.1	68.5	58.2	50.6	44.8	40.1	36.3
1.0	335.7	180.9	123.6	93.9	75.7	63.4	54.5	47.8	42.6	38.4

Height (m)	TSS Concentration (mg/L) at Lateral Distance from Plume Centerline (m)										
	0	50	100	150	200	250	300	350	400	450	500
100-m Downstream											
4.0	34.4	31.3	23.6	14.8	7.7	3.3	1.18	0.35	0.09	0.02	0.0
3.0	99.2	90.3	68.2	42.7	22.1	9.5	3.4	1.00	0.25	0.05	0.0
2.0	212.0	193.1	145.7	91.2	47.3	20.3	7.3	2.15	0.53	0.11	0.0
1.0	335.7	305.7	230.7	144.4	74.9	32.2	11.5	3.40	0.83	0.17	0.0
200-m Downstream											
4.0	57.1	54.5	47.3	37.4	27.0	17.7	10.6	5.7	2.8	1.28	0.53
3.0	97.4	93.0	80.8	63.9	46.0	30.2	18.0	9.8	4.9	2.2	0.90
2.0	143.1	136.5	118.6	93.8	67.6	44.3	26.5	14.4	7.1	3.2	1.32
1.0	180.9	172.6	150.0	118.6	85.5	56.0	33.5	18.2	9.0	4.1	1.67
400-m Downstream											
4.0	52.0	50.8	47.3	42.1	35.7	28.9	22.4	16.5	11.6	7.8	5.0
3.0	68.2	66.7	62.1	55.3	46.9	38.0	29.3	21.6	15.2	10.2	6.5
2.0	83.1	81.2	75.7	67.3	57.1	46.3	35.7	26.4	18.5	12.4	8.0
1.0	93.9	91.7	85.5	76.0	64.5	52.3	40.4	29.8	20.9	14.1	9.0

Table A-21 Predicted TSS Concentrations for Placement of Sand/Clay During Dike Construction, 2-cm/sec Current Velocity
 (2,400 yd³/hr Dredging Rate, 46.4% Fines)

Height (m)	TSS Concentration (mg/L) at Downstream Distance along Plume Centerline (m)									
	100	200	300	400	500	600	700	800	900	1000
4.0	241.0	179.7	136.8	109.6	91.2	78.0	68.2	60.5	54.3	49.3
3.0	345.2	216.1	155.2	120.8	98.8	83.5	72.3	63.8	57.0	51.5
2.0	447.5	247.2	170.3	129.8	104.8	87.9	75.7	66.4	59.2	53.4
1.0	524.9	269.0	180.7	136.1	109.1	91.0	78.1	68.3	60.8	54.7

Height (m)	TSS Concentration (mg/L) at Lateral Distance from Plume Centerline (m)										
	0	50	100	150	200	250	300	350	400	450	500
100-m Downstream											
4.0	241.0	226.4	187.7	137.3	88.6	50.5	25.4	11.3	4.4	1.5	0.5
3.0	345.2	324.3	268.9	196.7	127.0	72.4	36.4	16.1	6.3	2.2	0.7
2.0	447.5	420.4	348.5	255.0	164.6	93.8	47.2	20.9	8.2	2.8	0.9
1.0	524.9	493.1	408.8	299.1	193.1	110.0	55.3	24.5	9.6	3.3	1.0
200-m Downstream											
4.0	179.7	174.1	158.6	135.6	109.0	82.3	58.3	38.9	24.3	14.3	7.9
3.0	216.1	209.4	190.7	163.1	131.0	98.9	70.1	46.7	29.2	17.2	9.5
2.0	247.2	239.6	218.1	186.6	149.9	113.2	80.2	53.5	33.5	19.7	10.9
1.0	269.0	260.7	237.4	203.0	163.1	123.1	87.3	58.2	36.4	21.4	11.8
400-m Downstream											
4.0	109.6	107.9	103.0	95.2	85.4	74.2	62.5	51.0	40.3	30.9	23.0
3.0	120.8	118.9	113.5	104.9	94.1	81.7	68.8	56.2	44.4	34.1	25.3
2.0	129.8	127.8	121.9	112.8	101.1	87.8	74.0	60.4	47.8	36.6	27.2
1.0	136.1	133.9	127.8	118.2	106.0	92.1	77.5	63.3	50.1	38.4	28.5

Table A-22 Predicted TSS Concentrations for Placement of Soft Clay During Dike Construction, 10-cm/sec Current Velocity
 (2,400 yd³/hr Dredging Rate, 63.5% Fines)

Height (m)	TSS Concentration (mg/L) at Downstream Distance along Plume Centerline (m)									
	100	200	300	400	500	600	700	800	900	1000
4.0	8.9	33.0	42.8	44.8	43.8	41.7	39.3	36.9	34.7	32.7
3.0	51.6	79.5	77.1	69.8	62.5	56.1	50.7	46.2	42.4	39.1
2.0	181.1	149.3	117.6	95.8	80.6	69.4	61.0	54.3	48.9	44.5
1.0	385.3	218.3	151.7	116.2	94.1	79.1	68.2	59.9	53.5	48.2

Height (m)	TSS Concentration (mg/L) at Lateral Distance from Plume Centerline (m)										
	0	50	100	150	200	250	300	350	400	450	500
100-m Downstream											
4.0	8.9	7.6	4.8	2.19	0.73	0.18	0.03	0.00	0.00	0.0	0.0
3.0	51.6	44.2	27.6	12.7	4.2	1.04	0.19	0.02	0.00	0.0	0.0
2.0	181.1	154.9	96.9	44.4	14.9	3.6	0.65	0.09	0.01	0.0	0.0
1.0	385.3	329.6	206.3	94.4	31.6	7.8	1.39	0.18	0.02	0.0	0.0
200-m Downstream											
4.0	33.0	30.5	24.1	16.3	9.4	4.7	2.0	0.72	0.22	0.06	0.01
3.0	79.5	73.5	58.2	39.4	22.8	11.3	4.8	1.73	0.54	0.14	0.03
2.0	149.3	138.1	109.2	73.9	42.8	21.2	9.0	3.2	1.01	0.27	0.06
1.0	218.3	201.9	159.7	108.1	62.5	31.0	13.1	4.7	1.47	0.39	0.09
400-m Downstream											
4.0	44.8	43.1	38.3	31.5	24.0	16.9	11.0	6.6	3.7	1.89	0.90
3.0	69.8	67.1	59.7	49.1	37.3	26.3	17.1	10.3	5.7	2.9	1.40
2.0	95.8	92.2	82.0	67.4	51.3	36.1	23.5	14.1	7.9	4.0	1.93
1.0	116.2	111.7	99.4	81.7	62.2	43.8	28.5	17.1	9.5	4.9	2.34

Table A-23 Predicted TSS Concentrations for Placement of Soft Clay During Dike Construction, 6-cm/sec Current Velocity
 (2,400 yd³/hr Dredging Rate, 63.5% Fines)

Height (m)	TSS Concentration (mg/L) at Downstream Distance along Plume Centerline (m)									
	100	200	300	400	500	600	700	800	900	1000
4.0	44.6	74.1	73.7	67.5	60.9	55.0	49.9	45.6	41.9	38.7
3.0	128.2	125.9	105.1	88.2	75.5	65.8	58.2	52.2	47.3	43.2
2.0	272.8	184.1	135.6	106.9	88.1	74.9	65.2	57.6	51.6	46.8
1.0	429.9	231.7	158.4	120.3	96.9	81.2	69.8	61.3	54.6	49.2

Height (m)	TSS Concentration (mg/L) at Lateral Distance from Plume Centerline (m)										
	0	50	100	150	200	250	300	350	400	450	500
100-m Downstream											
4.0	44.6	40.6	30.7	19.2	10.0	4.3	1.53	0.45	0.11	0.02	0.0
3.0	128.2	116.7	88.1	55.1	28.6	12.3	4.4	1.30	0.32	0.07	0.0
2.0	272.8	248.4	187.5	117.3	60.9	26.2	9.3	2.76	0.68	0.14	0.0
1.0	429.9	391.5	295.5	184.9	95.9	41.3	14.7	4.35	1.07	0.22	0.0
200-m Downstream											
4.0	74.1	70.7	61.4	48.6	35.0	23.0	13.7	7.5	3.7	1.66	0.68
3.0	125.9	120.1	104.4	82.6	59.5	39.0	23.3	12.7	6.3	2.8	1.16
2.0	184.1	175.7	152.6	120.7	87.0	57.0	34.1	18.5	9.2	4.1	1.70
1.0	231.7	221.1	192.1	152.0	109.4	71.8	42.9	23.3	11.5	5.2	2.13
400-m Downstream											
4.0	67.5	65.9	61.5	54.7	46.4	37.6	29.0	21.4	15.1	10.1	6.5
3.0	88.2	86.2	80.3	71.4	60.6	49.1	37.9	28.0	19.7	13.2	8.5
2.0	106.9	104.5	97.4	86.6	73.5	59.5	46.0	33.9	23.9	16.0	10.3
1.0	120.3	117.5	109.5	97.4	82.7	66.9	51.7	38.1	26.8	18.0	11.5

Table A-24 Predicted TSS Concentrations for Placement of Soft Clay During Dike Construction, 2-cm/sec Current Velocity
 (2,400 yd³/hr Dredging Rate, 63.5% Fines)

Height (m)	TSS Concentration (mg/L) at Downstream Distance along Plume Centerline (m)									
	100	200	300	400	500	600	700	800	900	1000
4.0	315.0	234.9	178.9	143.4	119.4	102.2	89.3	79.2	71.2	64.6
3.0	449.2	281.3	202.1	157.3	128.7	108.9	94.3	83.2	74.4	67.3
2.0	579.7	320.3	220.8	168.3	136.0	114.1	98.2	86.3	76.9	69.3
1.0	676.9	347.0	233.2	175.6	140.8	117.5	100.9	88.3	78.6	70.7

Height (m)	TSS Concentration (mg/L) at Lateral Distance from Plume Centerline (m)										
	0	50	100	150	200	250	300	350	400	450	500
100-m Downstream											
4.0	315.0	295.9	245.3	179.48	115.9	66.0	33.2	14.7	5.8	2.0	0.61
3.0	449.2	422.0	349.9	256.0	165.3	94.2	47.4	21.0	8.2	2.8	0.87
2.0	579.7	544.6	451.5	330.3	213.3	121.5	61.1	27.1	10.6	3.7	1.12
1.0	676.9	635.9	527.2	385.7	249.0	141.9	71.3	31.7	12.4	4.3	1.31
200-m Downstream											
4.0	234.9	227.7	207.3	177.3	142.5	107.6	76.3	50.8	31.8	18.7	10.3
3.0	281.3	272.6	248.2	212.3	170.6	128.8	91.3	60.8	38.1	22.4	12.4
2.0	320.3	310.5	282.7	241.8	194.3	146.7	104.0	69.3	43.4	25.5	14.1
1.0	347.0	336.3	306.2	261.9	210.5	158.9	112.7	75.0	47.0	27.6	15.2
400-m Downstream											
4.0	143.4	141.2	134.7	124.6	111.7	97.1	81.7	66.7	52.8	40.5	30.1
3.0	157.3	154.9	147.8	136.7	122.5	106.5	89.6	73.2	57.9	44.4	33.0
2.0	168.3	165.7	158.1	146.2	131.1	113.9	95.9	78.3	61.9	47.5	35.3
1.0	175.6	172.9	165.0	152.6	136.8	118.8	100.1	81.7	64.6	49.5	36.8

Table A-25 Predicted TSS Concentrations for Placement of Hard Clay During Dike Construction, 10-cm/sec Current Velocity
 (920 yd³/hr Dredging Rate, 95% Fines)

Height (m)	TSS Concentration (mg/L) at Downstream Distance along Plume Centerline (m)									
	100	200	300	400	500	600	700	800	900	1000
4.0	4.4	16.1	20.9	21.9	21.4	20.4	19.2	18.1	17.0	16.0
3.0	25.2	38.8	37.6	34.0	30.5	27.4	24.7	22.5	20.7	19.1
2.0	88.2	72.7	57.3	46.7	39.3	33.8	29.7	26.4	23.8	21.7
1.0	187.4	106.2	73.8	56.5	45.8	38.5	33.2	29.1	26.0	23.5

Height (m)	TSS Concentration (mg/L) at Lateral Distance from Plume Centerline (m)										
	0	50	100	150	200	250	300	350	400	450	500
100-m Downstream											
4.0	4.4	3.7	2.3	1.07	0.36	0.09	0.02	0.00	0.00	0.0	0.0
3.0	25.2	21.5	13.5	6.2	2.1	0.51	0.09	0.01	0.00	0.0	0.0
2.0	88.2	75.4	47.2	21.6	7.2	1.8	0.32	0.04	0.00	0.0	0.0
1.0	187.4	160.3	100.3	45.9	15.4	3.8	0.68	0.09	0.01	0.0	0.0
200-m Downstream											
4.0	16.1	14.9	11.8	8.0	4.6	2.3	0.97	0.35	0.11	0.03	0.01
3.0	38.8	35.9	28.4	19.2	11.1	5.5	2.3	0.84	0.26	0.07	0.02
2.0	72.7	67.2	53.2	36.0	20.8	10.3	4.4	1.6	0.49	0.13	0.03
1.0	106.2	98.2	77.7	52.6	30.4	15.1	6.4	2.3	0.72	0.19	0.04
400-m Downstream											
4.0	21.9	21.1	18.7	15.4	11.7	8.2	5.4	3.2	1.8	0.93	0.44
3.0	34.0	32.7	29.1	23.9	18.2	12.8	8.3	5.0	2.8	1.4	0.69
2.0	46.7	44.9	39.9	32.8	25.0	17.6	11.4	6.9	3.8	2.0	0.94
1.0	56.5	54.3	48.3	39.8	30.2	21.3	13.8	8.3	4.6	2.4	1.14

Table A-26 Predicted TSS Concentrations for Placement of Hard Clay During Dike Construction, 6-cm/sec Current Velocity
 (920 yd³/hr Dredging Rate, 95% Fines)

Height (m)	TSS Concentration (mg/L) at Downstream Distance along Plume Centerline (m)									
	100	200	300	400	500	600	700	800	900	1000
4.0	20.5	34.0	33.8	31.0	27.9	25.2	22.9	20.9	19.2	17.8
3.0	58.7	57.7	48.2	40.4	34.6	30.2	26.7	23.9	21.7	19.8
2.0	124.8	84.2	62.1	48.9	40.3	34.3	29.8	26.4	23.6	21.4
1.0	196.4	105.9	72.4	54.9	44.3	37.1	31.9	28.0	24.9	22.5

Height (m)	TSS Concentration (mg/L) at Lateral Distance from Plume Centerline (m)										
	0	50	100	150	200	250	300	350	400	450	500
100-m Downstream											
4.0	20.5	18.7	14.1	8.8	4.6	2.0	0.70	0.21	0.05	0.01	0.0
3.0	58.7	53.5	40.4	25.3	13.1	5.6	2.0	0.59	0.15	0.03	0.0
2.0	124.8	113.6	85.8	53.7	27.8	12.0	4.3	1.26	0.31	0.06	0.0
1.0	196.4	178.8	135.0	84.5	43.8	18.8	6.7	1.99	0.49	0.10	0.0
200-m Downstream											
4.0	34.0	32.4	28.2	22.3	16.1	10.5	6.3	3.4	1.7	0.76	0.31
3.0	57.7	55.0	47.8	37.8	27.2	17.9	10.7	5.8	2.9	1.3	0.53
2.0	84.2	80.4	69.8	55.2	39.8	26.1	15.6	8.5	4.2	1.9	0.78
1.0	105.9	101.0	87.8	69.4	50.0	32.8	19.6	10.6	5.3	2.4	0.98
400-m Downstream											
4.0	31.0	30.3	28.2	25.1	21.3	17.2	13.3	9.8	6.9	4.6	3.0
3.0	40.4	39.5	36.8	32.7	27.8	22.5	17.4	12.8	9.0	6.1	3.9
2.0	48.9	47.8	44.5	39.6	33.6	27.2	21.0	15.5	10.9	7.3	4.7
1.0	54.9	53.7	50.0	44.5	37.8	30.6	23.6	17.4	12.3	8.2	5.3

Table A-27 Predicted TSS Concentrations for Placement of Hard Clay During Dike Construction, 2-cm/sec Current Velocity
 (920 yd³/hr Dredging Rate, 95% Fines)

Height (m)	TSS Concentration (mg/L) at Downstream Distance along Plume Centerline (m)									
	100	200	300	400	500	600	700	800	900	1000
4.0	136.1	101.5	77.3	62.0	51.6	44.2	38.6	34.2	30.8	27.9
3.0	193.8	121.3	87.2	67.9	55.5	47.0	40.7	35.9	32.1	29.0
2.0	249.7	138.0	95.1	72.5	58.6	49.1	42.3	37.2	33.1	29.9
1.0	291.1	149.2	100.3	75.5	60.6	50.6	43.4	38.0	33.8	30.4

Height (m)	TSS Concentration (mg/L) at Lateral Distance from Plume Centerline (m)										
	0	50	100	150	200	250	300	350	400	450	500
100-m Downstream											
4.0	136.1	127.8	106.0	77.5	50.1	28.5	14.3	6.4	2.5	0.86	0.26
3.0	193.8	182.0	150.9	110.4	71.3	40.6	20.4	9.1	3.5	1.2	0.37
2.0	249.7	234.6	194.5	142.3	91.9	52.3	26.3	11.7	4.6	1.6	0.48
1.0	291.1	273.5	226.7	165.9	107.1	61.0	30.7	13.6	5.3	1.8	0.56
200-m Downstream											
4.0	101.5	98.4	89.6	76.6	61.6	46.5	33.0	21.9	13.7	8.1	4.5
3.0	121.3	117.6	107.1	91.6	73.6	55.5	39.4	26.2	16.4	9.7	5.3
2.0	138.0	133.7	121.8	104.1	83.7	63.2	44.8	29.8	18.7	11.0	6.1
1.0	149.2	144.6	131.7	112.6	90.5	68.3	48.4	32.3	20.2	11.9	6.6
400-m Downstream											
4.0	62.0	61.0	58.2	53.8	48.3	41.9	35.3	28.8	22.8	17.5	13.0
3.0	67.9	66.8	63.8	59.0	52.9	45.9	38.7	31.6	25.0	19.1	14.2
2.0	72.5	71.4	68.1	63.0	56.5	49.1	41.3	33.7	26.7	20.5	15.2
1.0	75.5	74.4	71.0	65.6	58.8	51.1	43.0	35.1	27.8	21.3	15.8

Table A-28 Calculated Dissolved Metal Concentrations Resulting from Clamshell Dredging of the Overburden
 (6-cm/sec Average Tidal Velocity)

Width (m)	Concentration (ug/L) at Downstream Distance (m) Along Plume Centerline											
	20	60	100	200	300	400	500	600	700	800	900	1000
CHROMIUM												
0	1.67	1.54	1.46	1.32	1.23	1.15	1.09	1.03	0.99	0.94	0.90	0.86
50	1.57	1.49	1.43	1.31	1.22	1.14	1.08	1.03	0.98	0.94	0.90	0.85
100	1.03	1.33	1.32	1.25	1.18	1.11	1.06	1.01	0.96	0.92	0.88	0.84
COPPER												
0	3.14	2.86	2.69	2.41	2.22	2.07	1.94	1.83	1.74	1.65	1.57	1.50
50	2.91	2.76	2.62	2.37	2.19	2.05	1.92	1.82	1.72	1.65	1.57	1.49
100	1.83	2.42	2.41	2.25	2.11	1.99	1.88	1.78	1.69	1.61	1.54	1.47
LEAD												
0	3.12	2.88	2.72	2.47	2.30	2.16	2.04	1.93	1.84	1.76	1.67	1.60
50	2.92	2.79	2.66	2.44	2.27	2.13	2.02	1.92	1.82	1.75	1.67	1.59
100	1.93	2.48	2.47	2.33	2.20	2.08	1.97	1.88	1.79	1.71	1.64	1.57
MERCURY												
0	0.0031	0.0031	0.0030	0.0030	0.0029	0.0029	0.0028	0.0028	0.0027	0.0027	0.0027	0.0026
50	0.0031	0.0030	0.0030	0.0030	0.0029	0.0029	0.0028	0.0028	0.0027	0.0027	0.0027	0.0026
100	0.0028	0.0030	0.0030	0.0029	0.0029	0.0028	0.0028	0.0028	0.0027	0.0027	0.0027	0.0026
NICKEL												
0	0.82	0.66	0.58	0.47	0.40	0.36	0.32	0.30	0.27	0.25	0.24	0.22
50	0.68	0.61	0.55	0.45	0.40	0.35	0.32	0.29	0.27	0.25	0.24	0.22
100	0.30	0.47	0.47	0.42	0.37	0.34	0.31	0.28	0.26	0.24	0.23	0.21
ZINC												
0	11.99	9.93	8.84	7.29	6.37	5.70	5.19	4.76	4.42	4.11	3.83	3.60
50	10.29	9.30	8.45	7.10	6.24	5.61	5.11	4.70	4.36	4.08	3.83	3.56
100	4.76	7.36	7.29	6.53	5.89	5.37	4.92	4.56	4.24	3.96	3.73	3.50

Table A-29 Calculated Total Nitrogen and Dissolved PCB Concentrations Resulting from Clamshell Dredging in the Overburden
 (6-cm/sec Average Tidal Velocity)

Height (m)	Concentration (ug/L) at Downstream Distance (m) Along Plume Centerline											
	20	60	100	200	300	400	500	600	700	800	900	1000
NO ₂ + NO ₃ (ug/L)												
0	0.33	0.19	0.15	0.10	0.08	0.07	0.06	0.05	0.05	0.04	0.04	0.04
50	0.21	0.16	0.13	0.10	0.08	0.07	0.06	0.05	0.05	0.04	0.04	0.03
100	0.05	0.10	0.10	0.08	0.07	0.06	0.05	0.05	0.04	0.04	0.04	0.03
TKN (ug/L)												
0	253.6	144.9	110.7	76.1	60.4	50.8	44.1	39.0	35.2	32.0	29.1	26.9
50	158.6	123.8	100.7	72.6	58.5	49.6	43.2	38.4	34.5	31.7	29.1	26.5
100	39.0	77.4	76.1	63.0	53.4	46.4	40.9	36.8	33.3	30.4	28.1	25.9
PHOSPHORUS (ug/L)												
0	75.3	43.0	32.8	22.6	17.9	15.1	13.1	11.6	10.4	9.49	8.64	7.97
50	47.1	36.7	29.9	21.5	17.4	14.7	12.8	11.4	10.2	9.40	8.64	7.88
100	11.6	23.0	22.6	18.7	15.8	13.8	12.1	10.9	9.87	9.02	8.35	7.69
PCB (ng/L)												
0	7.47	4.97	4.12	3.20	2.73	2.43	2.20	2.01	1.87	1.74	1.63	1.53
50	5.30	4.45	3.87	3.10	2.67	2.38	2.16	1.99	1.85	1.73	1.63	1.52
100	2.01	3.23	3.20	2.81	2.51	2.28	2.08	1.93	1.80	1.68	1.59	1.49

Table A-30 Calculated Dissolved Metal Concentrations Resulting from Cutterhead Dredging of Sand in the Borrow
 (6-cm/sec Average Tidal Velocity)

Height (m)	Concentration (ug/L) at Downstream Distance (m) Along Plume Centerline												
	20	40	60	100	200	300	400	500	600	700	800	900	1000
CHROMIUM													
3.0	0.02	0.21	0.35	0.45	0.44	0.40	0.35	0.32	0.29	0.27	0.24	0.22	0.21
2.0	0.45	0.66	0.68	0.65	0.55	0.47	0.41	0.36	0.33	0.29	0.27	0.25	0.23
1.0	0.92	0.88	0.84	0.76	0.62	0.52	0.45	0.39	0.35	0.32	0.28	0.26	0.24
0.5	0.98	0.92	0.87	0.79	0.64	0.53	0.46	0.40	0.36	0.32	0.29	0.27	0.25
COPPER													
3.0	0.03	0.36	0.63	0.81	0.80	0.71	0.63	0.57	0.51	0.47	0.42	0.39	0.37
2.0	0.80	1.22	1.27	1.21	1.01	0.85	0.73	0.65	0.58	0.52	0.47	0.43	0.40
1.0	1.79	1.71	1.61	1.44	1.14	0.95	0.80	0.70	0.62	0.56	0.50	0.46	0.42
0.5	1.91	1.79	1.68	1.50	1.18	0.97	0.82	0.72	0.64	0.57	0.52	0.47	0.43
LEAD													
3.0	0.09	1.08	1.83	2.33	2.29	2.06	1.83	1.66	1.50	1.38	1.25	1.15	1.09
2.0	2.31	3.40	3.51	3.37	2.84	2.43	2.12	1.88	1.69	1.52	1.38	1.29	1.19
1.0	4.78	4.57	4.35	3.95	3.20	2.69	2.31	2.04	1.81	1.63	1.47	1.35	1.25
0.5	5.04	4.77	4.51	4.08	3.29	2.76	2.36	2.08	1.86	1.66	1.52	1.38	1.29
MERCURY													
3.0	0.0001	0.0009	0.0012	0.0013	0.0012	0.0012	0.0012	0.0011	0.0011	0.0010	0.0010	0.0009	0.0009
2.0	0.0013	0.0014	0.0014	0.0014	0.0013	0.0013	0.0012	0.0012	0.0011	0.0011	0.0010	0.0010	0.0010
1.0	0.0015	0.0015	0.0015	0.0014	0.0014	0.0013	0.0013	0.0012	0.0012	0.0011	0.0011	0.0010	0.0010
0.5	0.0015	0.0015	0.0015	0.0015	0.0014	0.0013	0.0013	0.0012	0.0012	0.0011	0.0011	0.0010	0.0010
NICKEL													
3.0	0.00	0.04	0.08	0.11	0.11	0.09	0.08	0.07	0.06	0.06	0.05	0.05	0.04
2.0	0.11	0.21	0.22	0.20	0.15	0.12	0.10	0.08	0.07	0.06	0.06	0.05	0.05
1.0	0.44	0.39	0.35	0.28	0.18	0.14	0.11	0.09	0.08	0.07	0.06	0.05	0.05
0.5	0.52	0.44	0.38	0.30	0.19	0.14	0.11	0.10	0.08	0.07	0.06	0.06	0.05
ZINC													
3.0	0.04	0.56	1.07	1.47	1.44	1.24	1.07	0.94	0.83	0.75	0.67	0.61	0.57
2.0	1.46	2.64	2.80	2.61	1.98	1.57	1.30	1.11	0.96	0.85	0.75	0.69	0.63
1.0	5.25	4.73	4.23	3.47	2.38	1.81	1.46	1.23	1.05	0.92	0.81	0.73	0.67
0.5	6.03	5.22	4.60	3.71	2.50	1.88	1.50	1.26	1.09	0.94	0.85	0.75	0.69

Table A-31 Calculated Total Nitrogen and Dissolved PCB Concentrations Resulting from Cutterhead Dredging of Sand in the Borrow
 (6-cm/sec Average Tidal Velocity)

Height (m)	Concentration (ug/L) at Downstream Distance (m) Along Plume Centerline												
	20	40	60	100	200	300	400	500	600	700	800	900	1000
NO₂ + NO₃ (ug/L)													
3.0	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.00	0.00	0.00
2.0	0.01	0.03	0.03	0.03	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.00
1.0	0.12	0.09	0.06	0.04	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.00
0.5	0.21	0.11	0.08	0.05	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.01
TKN (ug/L)													
3.0	1.57	22.8	47.2	69.4	67.5	56.4	47.2	40.7	35.1	31.4	27.7	25.0	23.1
2.0	68.4	154.4	169.2	151.7	101.7	74.9	59.2	49.0	41.6	36.1	31.4	28.7	25.9
1.0	676.0	492.0	371.8	246.0	132.2	90.6	68.4	55.5	46.2	39.8	34.2	30.5	27.7
0.5	1208	663.1	455.9	280.2	142.4	95.3	71.2	57.3	48.1	40.7	36.1	31.4	28.7
PHOSPHORUS (ug/L)													
3.0	0.09	1.25	2.58	3.80	3.69	3.09	2.58	2.23	1.92	1.72	1.52	1.37	1.27
2.0	3.74	8.45	9.26	8.30	5.57	4.10	3.24	2.68	2.28	1.97	1.72	1.57	1.42
1.0	37.0	26.9	20.3	13.5	7.24	4.96	3.74	3.04	2.53	2.18	1.87	1.67	1.52
0.5	66.1	36.3	24.9	15.3	7.79	5.21	3.90	3.14	2.63	2.23	1.97	1.72	1.57
PCB (ng/L)													
3.0	0.01	0.20	0.41	0.60	0.58	0.49	0.41	0.36	0.31	0.28	0.25	0.22	0.21
2.0	0.59	1.25	1.36	1.23	0.85	0.64	0.51	0.43	0.37	0.32	0.28	0.25	0.23
1.0	4.20	3.31	2.65	1.88	1.09	0.77	0.59	0.48	0.40	0.35	0.30	0.27	0.25
0.5	6.35	4.14	3.12	2.10	1.16	0.80	0.61	0.50	0.42	0.36	0.32	0.28	0.25

Table A-32 Calculated Dissolved Metal Concentrations Resulting from Cutterhead Dredging of Soft Clay in the Borrow
 (6-cm/sec Average Tidal Velocity)

Height (m)	Concentration (ug/L) at Downstream Distance (m) Along Plume Centerline												
	20	40	60	100	200	300	400	500	600	700	800	900	1000
CHROMIUM													
3.0	0.04	0.41	0.60	0.70	0.69	0.65	0.60	0.56	0.53	0.49	0.47	0.44	0.42
2.0	0.69	0.85	0.86	0.85	0.78	0.71	0.65	0.60	0.56	0.53	0.49	0.46	0.44
1.0	1.00	0.98	0.95	0.91	0.82	0.74	0.68	0.63	0.58	0.54	0.51	0.48	0.45
0.5	1.02	0.99	0.97	0.93	0.83	0.75	0.69	0.63	0.59	0.55	0.51	0.48	0.45
COPPER													
3.0	0.08	0.74	1.11	1.30	1.29	1.20	1.11	1.03	0.96	0.90	0.84	0.80	0.75
2.0	1.29	1.63	1.66	1.63	1.47	1.33	1.21	1.11	1.03	0.96	0.89	0.84	0.79
1.0	1.96	1.91	1.86	1.77	1.56	1.40	1.27	1.16	1.07	0.99	0.93	0.87	0.81
0.5	2.01	1.95	1.90	1.80	1.59	1.42	1.29	1.17	1.08	1.00	0.94	0.87	0.82
LEAD													
3.0	0.23	2.14	3.10	3.60	3.58	3.35	3.12	2.92	2.73	2.56	2.41	2.29	2.16
2.0	3.56	4.40	4.47	4.38	4.01	3.67	3.37	3.12	2.90	2.72	2.54	2.40	2.27
1.0	5.15	5.05	4.93	4.72	4.24	3.85	3.52	3.25	3.02	2.81	2.63	2.48	2.33
0.5	5.27	5.14	5.01	4.78	4.29	3.89	3.56	3.28	3.04	2.83	2.66	2.50	2.35
MERCURY													
3.0	0.0003	0.0012	0.0014	0.0014	0.0014	0.0014	0.0014	0.0013	0.0013	0.0013	0.0013	0.0012	0.0012
2.0	0.0014	0.0015	0.0015	0.0015	0.0014	0.0014	0.0014	0.0014	0.0013	0.0013	0.0013	0.0013	0.0012
1.0	0.0015	0.0015	0.0015	0.0015	0.0015	0.0014	0.0014	0.0014	0.0014	0.0013	0.0013	0.0013	0.0013
0.5	0.0015	0.0015	0.0015	0.0015	0.0015	0.0014	0.0014	0.0014	0.0014	0.0013	0.0013	0.0013	0.0013
NICKEL													
3.0	0.01	0.10	0.18	0.23	0.23	0.20	0.18	0.16	0.14	0.13	0.12	0.11	0.10
2.0	0.22	0.35	0.37	0.35	0.29	0.24	0.20	0.18	0.16	0.14	0.13	0.12	0.11
1.0	0.55	0.52	0.48	0.42	0.32	0.26	0.22	0.19	0.17	0.15	0.13	0.12	0.11
0.5	0.59	0.55	0.51	0.44	0.33	0.27	0.22	0.19	0.17	0.15	0.14	0.12	0.11
ZINC													
3.0	0.11	1.31	2.27	2.93	2.89	2.58	2.29	2.06	1.86	1.69	1.55	1.44	1.33
2.0	2.86	4.33	4.50	4.30	3.58	3.02	2.61	2.29	2.04	1.84	1.67	1.54	1.43
1.0	6.36	6.04	5.69	5.09	4.01	3.30	2.81	2.45	2.17	1.94	1.76	1.61	1.47
0.5	6.78	6.33	5.93	5.27	4.12	3.38	2.86	2.48	2.19	1.96	1.79	1.63	1.49

Table A-33 Calculated Total Nitrogen and Dissolved PCB Concentrations Resulting from Cutterhead Dredging of Soft Clay in the Borrow
 (6-cm/sec Average Tidal Velocity)

Height (m)	Concentration (ug/L) at Downstream Distance (m) Along Plume Centerline												
	20	40	60	100	200	300	400	500	600	700	800	900	1000
NO₂ + NO₃ (ug/L)													
3.0	0.00	0.01	0.02	0.03	0.03	0.03	0.02	0.02	0.02	0.01	0.01	0.01	0.01
2.0	0.03	0.07	0.07	0.07	0.05	0.03	0.03	0.02	0.02	0.02	0.01	0.01	0.01
1.0	0.29	0.21	0.16	0.11	0.06	0.04	0.03	0.02	0.02	0.02	0.02	0.01	0.01
0.5	0.51	0.28	0.19	0.12	0.06	0.04	0.03	0.02	0.02	0.02	0.02	0.01	0.01
TKN (ug/L)													
3.0	4.07	60.1	123.0	182.2	178.5	148.9	124.8	107.3	93.4	82.3	74.0	67.5	61.0
2.0	175.7	393.0	431.9	386.6	260.8	192.4	151.7	124.8	106.4	92.5	81.4	73.1	66.6
1.0	1674	1217	920.2	609.4	328.3	224.7	170.2	137.8	115.6	99.0	86.9	77.7	69.4
0.5	2945	1617	1113	684.4	348.7	234.0	175.7	140.6	117.5	100.8	88.8	78.6	70.3
PHOSPHORUS (ug/L)													
3.0	0.22	3.29	6.73	9.97	9.77	8.15	6.83	5.87	5.11	4.50	4.05	3.69	3.34
2.0	9.61	21.5	23.6	21.2	14.3	10.5	8.30	6.83	5.82	5.06	4.45	4.00	3.64
1.0	91.6	66.6	50.3	33.3	18.0	12.3	9.31	7.54	6.33	5.41	4.76	4.25	3.80
0.5	161.1	88.4	60.9	37.4	19.1	12.8	9.61	7.69	6.43	5.52	4.86	4.30	3.85
PCB (ng/L)													
3.0	0.04	0.52	1.02	1.45	1.42	1.21	1.03	0.90	0.79	0.70	0.63	0.58	0.53
2.0	1.40	2.77	2.99	2.73	1.98	1.52	1.23	1.03	0.89	0.78	0.69	0.63	0.57
1.0	7.93	6.38	5.25	3.89	2.39	1.74	1.36	1.13	0.96	0.83	0.74	0.66	0.60
0.5	11.67	7.75	6.00	4.24	2.52	1.80	1.40	1.15	0.98	0.85	0.75	0.67	0.60

Table A-34 Calculated Dissolved Metal Concentrations Resulting from Placement of Sand During Dike Construction
(6-cm/sec Average Tidal Velocity)

Height (m)	Concentration (ug/L) at Downstream Distance (m) Along Plume Centerline									
	100	200	300	400	500	600	700	800	900	1000
CHROMIUM										
4.0	0.75	0.85	0.85	0.83	0.81	0.79	0.77	0.75	0.74	0.72
3.0	0.93	0.92	0.90	0.88	0.85	0.83	0.81	0.79	0.77	0.75
2.0	0.99	0.96	0.94	0.91	0.88	0.86	0.83	0.81	0.79	0.77
1.0	1.01	0.98	0.95	0.93	0.90	0.87	0.85	0.83	0.81	0.79
COPPER										
4.0	1.42	1.63	1.62	1.59	1.55	1.51	1.47	1.43	1.39	1.35
3.0	1.80	1.80	1.75	1.69	1.64	1.59	1.54	1.50	1.45	1.41
2.0	1.94	1.88	1.82	1.76	1.70	1.65	1.60	1.55	1.51	1.46
1.0	2.00	1.93	1.86	1.80	1.74	1.69	1.63	1.59	1.54	1.50
LEAD										
4.0	3.90	4.39	4.38	4.30	4.20	4.10	4.00	3.90	3.80	3.71
3.0	4.79	4.78	4.67	4.54	4.42	4.30	4.19	4.08	3.97	3.87
2.0	5.12	4.98	4.84	4.70	4.56	4.44	4.32	4.20	4.10	3.99
1.0	5.23	5.08	4.93	4.79	4.65	4.52	4.40	4.29	4.18	4.07
MERCURY										
4.0	0.0014	0.0015	0.0015	0.0015	0.0015	0.0015	0.0014	0.0014	0.0014	0.0014
3.0	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015	0.0014	0.0014
2.0	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015	0.0014
1.0	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015
NICKEL										
4.0	0.27	0.35	0.35	0.34	0.32	0.30	0.29	0.27	0.26	0.24
3.0	0.44	0.44	0.41	0.39	0.36	0.34	0.32	0.30	0.28	0.27
2.0	0.54	0.50	0.46	0.42	0.39	0.36	0.34	0.32	0.30	0.28
1.0	0.58	0.53	0.48	0.44	0.41	0.38	0.36	0.33	0.31	0.30
ZINC										
4.0	3.39	4.31	4.30	4.14	3.94	3.75	3.57	3.39	3.24	3.09
3.0	5.29	5.26	4.97	4.67	4.39	4.14	3.91	3.70	3.51	3.34
2.0	6.27	5.83	5.41	5.04	4.71	4.43	4.17	3.94	3.74	3.55
1.0	6.67	6.13	5.67	5.27	4.93	4.62	4.35	4.11	3.89	3.69

Table A-35 Calculated Total Nitrogen and Dissolved PCB Concentrations Resulting from Placement of Sand
During Dike Construction (6-cm/sec Average Tidal Velocity)

Height (m)	Concentration (ug/L) at Downstream Distance (m) Along Plume Centerline									
	100	200	300	400	500	600	700	800	900	1000
NO ₂ + NO ₃ (ug/L)										
4.0	0.04	0.07	0.07	0.06	0.05	0.05	0.04	0.04	0.04	0.03
3.0	0.12	0.12	0.10	0.08	0.07	0.06	0.05	0.05	0.04	0.04
2.0	0.26	0.18	0.13	0.10	0.08	0.07	0.06	0.05	0.05	0.04
1.0	0.43	0.23	0.16	0.12	0.10	0.08	0.07	0.06	0.05	0.05
TKN (ug/L)										
4.0	234.9	388.4	385.6	352.3	317.2	285.8	258.9	235.8	216.4	199.8
3.0	693.6	679.7	566.9	474.4	405.1	352.3	311.7	278.4	251.5	229.4
2.0	1521	1025	753.7	592.8	487.4	413.4	358.8	317.2	283.9	256.2
1.0	2471	1329	906.3	687.1	553.0	461.5	396.7	346.8	308.9	277.4
PHOSPHORUS (ug/L)										
4.0	12.9	21.3	21.1	19.3	17.4	15.6	14.2	12.9	11.8	10.9
3.0	38.0	37.2	31.0	26.0	22.2	19.3	17.1	15.2	13.8	12.5
2.0	83.2	56.1	41.2	32.4	26.7	22.6	19.6	17.4	15.5	14.0
1.0	135.2	72.7	49.6	37.6	30.3	25.2	21.7	19.0	16.9	15.2
PCB (ng/L)										
4.0	1.81	2.74	2.73	2.54	2.33	2.13	1.96	1.81	1.68	1.57
3.0	4.28	4.22	3.69	3.21	2.84	2.54	2.29	2.09	1.92	1.77
2.0	7.43	5.66	4.55	3.81	3.28	2.88	2.57	2.33	2.12	1.95
1.0	10.34	6.78	5.19	4.25	3.62	3.15	2.79	2.50	2.28	2.08

Table A-36 Calculated Dissolved Metal Concentrations Resulting from Placement of Soft Clay During Dike Construction
 (6-cm/sec Average Tidal Velocity)

Height (m)	Concentration (ug/L) at Downstream Distance (m) Along Plume Centerline									
	100	200	300	400	500	600	700	800	900	1000
CHROMIUM										
4.0	0.86	0.93	0.93	0.92	0.90	0.89	0.88	0.86	0.85	0.83
3.0	0.97	0.97	0.96	0.94	0.93	0.91	0.90	0.88	0.87	0.85
2.0	1.01	1.00	0.98	0.96	0.94	0.93	0.91	0.90	0.88	0.87
1.0	1.03	1.01	0.99	0.97	0.95	0.94	0.92	0.90	0.89	0.87
COPPER										
4.0	1.65	1.80	1.80	1.77	1.75	1.72	1.69	1.66	1.63	1.60
3.0	1.91	1.90	1.87	1.84	1.80	1.77	1.73	1.70	1.67	1.64
2.0	2.00	1.96	1.92	1.88	1.84	1.80	1.76	1.73	1.70	1.66
1.0	2.03	1.98	1.94	1.90	1.86	1.82	1.78	1.75	1.71	1.68
LEAD										
4.0	4.44	4.78	4.78	4.73	4.66	4.60	4.52	4.45	4.38	4.32
3.0	5.04	5.03	4.96	4.88	4.80	4.71	4.63	4.56	4.48	4.41
2.0	5.24	5.15	5.06	4.97	4.88	4.79	4.71	4.63	4.55	4.47
1.0	5.31	5.21	5.11	5.01	4.92	4.84	4.75	4.67	4.59	4.51
MERCURY										
4.0	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015
3.0	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015
2.0	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015
1.0	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015
NICKEL										
4.0	0.36	0.44	0.44	0.43	0.41	0.40	0.38	0.37	0.35	0.34
3.0	0.51	0.51	0.49	0.47	0.44	0.42	0.41	0.39	0.37	0.36
2.0	0.58	0.55	0.52	0.49	0.47	0.44	0.42	0.40	0.39	0.37
1.0	0.61	0.57	0.54	0.51	0.48	0.46	0.43	0.41	0.40	0.38
ZINC										
4.0	4.42	5.27	5.26	5.12	4.96	4.79	4.62	4.46	4.31	4.16
3.0	6.01	5.98	5.76	5.53	5.30	5.08	4.88	4.70	4.53	4.36
2.0	6.68	6.38	6.07	5.79	5.52	5.29	5.07	4.87	4.68	4.51
1.0	6.94	6.57	6.23	5.93	5.66	5.41	5.18	4.97	4.77	4.59

Table A-37 Calculated Total Nitrogen and Dissolved PCB Concentrations Resulting from Placement of Soft Clay During Dike Construction (6-cm/sec Average Tidal Velocity)

Height (m)	Concentration (ug/L) at Downstream Distance (m) Along Plume Centerline									
	100	200	300	400	500	600	700	800	900	1000
NO ₂ + NO ₃ (ug/L)										
4.0	0.07	0.12	0.12	0.11	0.10	0.09	0.08	0.07	0.07	0.06
3.0	0.21	0.20	0.17	0.14	0.12	0.11	0.09	0.08	0.08	0.07
2.0	0.44	0.29	0.22	0.17	0.14	0.12	0.10	0.09	0.08	0.07
1.0	0.69	0.37	0.25	0.19	0.16	0.13	0.11	0.10	0.09	0.08
TKN (ug/L)										
4.0	412.5	685.3	681.6	624.2	563.2	508.6	461.5	421.7	387.5	357.9
3.0	1186	1164	972.0	815.7	698.2	608.5	538.2	482.7	437.4	399.5
2.0	2523	1703	1254	988.6	814.7	692.7	603.0	532.7	477.2	432.8
1.0	3976	2143	1465	1113	896.1	750.9	645.5	566.9	504.9	455.0
PHOSPHORUS (ug/L)										
4.0	22.6	37.5	37.3	34.2	30.8	27.8	25.2	23.1	21.2	19.6
3.0	64.9	63.7	53.2	44.6	38.2	33.3	29.4	26.4	23.9	21.9
2.0	138.0	93.2	68.6	54.1	44.6	37.9	33.0	29.1	26.1	23.7
1.0	217.5	117.2	80.2	60.9	49.0	41.1	35.3	31.0	27.6	24.9
PCB (ng/L)										
4.0	2.88	4.25	4.23	3.96	3.67	3.39	3.15	2.93	2.74	2.57
3.0	6.27	6.19	5.46	4.82	4.30	3.89	3.54	3.26	3.02	2.81
2.0	10.48	8.02	6.51	5.52	4.81	4.28	3.86	3.52	3.23	2.99
1.0	14.43	9.38	7.24	6.00	5.15	4.54	4.06	3.69	3.37	3.11

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